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AMERICAN JOURNAL of PHARMACY

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A Record of the Progress of Pharmacy and the Allied Sciences

COMMITTEE ON PUBLICATION.

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THE AMERICAN
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VOL. 96. AUGUST, 1924. NO. 8.

EDITORIAL

OPIUM LOSING ITS GRIP.

Advocates of Prohibition are confident that the Volstead regime will in time become an absolute reality. Give it time to show its good results—and in spite of the brewers and petty politicians—in spite of overzealous drys and damps—Prohibition will eventually score its goal. That is their argument.

And they can derive comfort and courage to carry on from the story of the fall and decline of the opium empire. For here Education, Legislation and Law-enforcement have laid low the vicious malignancy that for a time menaced the vitals of our country.

From a total of 264,000 drug addicts within our borders in 1900, there has been a gradual but insistent decrease until we are told that the number has shrunk to only a little over a hundred thousand. And this is information that comes from a reliable source.*

We grant that this estimate is much lower than other recent estimates, as, for example, that broadcast by the International Narcotic Education Association, Incorporated, of Los Angeles, which placed the number of heroin addicts alone as high as 1,000,000. This Californian organization, although sponsored by a group of prominent physicians, certainly erred in this figure—but being Californians—and probably members of the Chamber of Commerce of the angelic city—an error of a few hundred thousand can be courteously overlooked.

The actual fact is that there was never enough heroin manufactured in and imported into this country, through legal or illegal channels, to supply a million habitues with their necessary "snow." In the interest of truth, however, it is exceedingly unfortunate that well intentioned but ill-informed organizations such as this should

*Kolb, Lawrence and DuMez, A. G.: The Prevalence and Trend of Drug Addiction in the United States and Factors Influencing It. Pub. Health Rep. 39: 1179 (May 23), 1924.

juggle figures so fantastically. The report of the Public Health Service states:

> "To supply with their daily doses the large number of addicts asserted by some to be residing in this country, would require enormous quantities of narcotics—quantities far in excess of those imported at the present time or during any period in the past."

Heroin—introduced by a German chemical house—as a medicinal did indeed become a menace—but heroin is no longer with us. It has been officially banned. The Porter bill, prohibiting the importation of opium for use in the manufacture of heroin, passed both branches of Congress and has been signed by President Coolidge. No more heroin can be made or sold lawfully within the confines of the United States, nor can it be imported as such. Of course some will still be smuggled in but only in negligible amounts.

Next will be cocain. In a recent canvass of physicians and dentists eighty-three per cent. of the physicians and ninety-four per cent. of the dentists were of the opinion that cocain could be dispensed with in practice through the use of procain or other non-habit forming synthetic compounds.

And so there will eventually come a complete conquest of the addict problem. It will indeed cease to be a problem, provided of course that restrictive measures continue to be enforced without abatement.

"From the trend which narcotic addiction in this country has taken in recent years as a result of the attention given the problem by the professions and by law enforcement officers, it is believed that we may confidently look forward to the time, not many years distant, when the few remaining addicts will be persons taking opium only because of an incurable disease, and addicts of the psychopathic delinquent type who spend a good part of their lives in prison." So ends the report.

Reports of Governmental Bureaus are very commonly desiccated and unpleasant to browse over, but here is one at least that gives comfort to every citizen—and the authors are to be congratulated on the completeness of their compilation and for the blessed joy that is in their message.

IVOR GRIFFITH.

ANOTHER INSTITUTION OF (L)EARNING.

The Dean of a prominent institution, commenting on the letter which is printed herewith said "they seem to have advantages over us, don't they?"

—— And we agreed with him—for we knew that the institution which he represented had not the affrontery nor the quack-altruism to qualify for comparison with this new institution of earning.

Really we hesitate to print the letter, fearing that it might desecrate the pages of this old and respectable journal, but there is so much down-right nonsense and chicanery to the whole thing that we are urged to print it and comment upon its unworthy substance.

It starts with a promise of a remarkable extension of life—read the first paragraph—and unless overwhelmingly nauseated—go on to the end.

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We would be unable to do anything for you then, but NOW we can probably enable you to lengthen your life by these added years, if you act NOW.

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Every day thousands die unnecessarily of Diabetes, Bright's Disease, Heart and Kidney disorders, etc. If these people had been successfully treated when they FIRST contracted the disease, they could, in many cases, have lived these added years.

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And do not forget that the Life Membership in the International Health Club may be worth many times what you pay for the entire Course and Outfit. This membership entitles you to write in, as often as you wish to the College for information as to the results which you obtain with your outfit.

If you should ask your physician these questions, it would cost you at least three dollars each time, but you may consult us concerning the results which you obtain without charge—as often as you wish—and THEN, if necessary, we will advise you to consult your physician.

Then, remember, too, that the College is incorporated under the Laws of the State of Illinois as an Institution NOT FOR PROFIT and this saving is passed along to you.

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. . . . . .

Out of Chicago has often come the cry that the best defense of legitimate medicine against the assaults of the cults, the —paths, the —isms and the —ics is general health education and so it is deemed wise to educate the public to evaluate the medical adviser properly—to try the doctor and not the drug store first—to see the physician face to face and not simply adorning the label of the patent medicine bottle. But the group of thinkers on Dearborn Street have apparently missed one bet and Garfield Avenue has taken advantage.

Dearborn Street never realized the advantage to be gained by making every man his own analyst. Here in Philadelphia, thanks to Garfield Avenue, mah-jong and radio are no longer the vogue. Everybody prefers analyzing—and the mortality among test-tubes has become appalling.

But then there is the recompense in knowing that for a paltry fee the death-bed is removed to an attic "5, 10, 15 or 20 years," distant.

Truly this is a remarkable age.

IVOR GRIFFITH.

ORIGINAL ARTICLES

CHOCOLATE.*

By E. Fullerton Cook, Ph. M.

When one combines in food or drink something that appeals to both the imagination and palate, perfection has been reached. Who would not be stimulated, if as they drink their cup of steaming chocolate their thoughts could be taken back to the year 1519 when Cortez, the Spanish conqueror of Mexico, returned to England. The gathering of his friends about him and their interest can be pictured, as he tells them of this strange food and drink unknown to Europe but in common use among the Aztecs for at least several centuries.

He told of how the perfect beans were used as a means of exchange, and were called "blessed money" since they could not be hoarded or hidden underground and so did not induce avarice, and that one hundred thousand tons of it were used annually in the royal palace of Mexico during the days of prosperity among the Aztecs. He told of how the gift of the cacao seed, which was said to have grown in Eden for the delight of men and gods was attributed directly to Divine Providence.

He explained the method of preparation which not only included its roasting and grinding but also the addition of vanilla and sugar, both native to their country, and also told of a combination which had been devised in the form of froth to be held in the mouth without swallowing until it automatically passed into the stomach. This was served to the Emperor, Montezuma, in goblets of gold or tortoise-shell beautifully carved; the goblets, after a single use, being tossed into the lake surrounding the palace. Fifty jars or pitchers of chocolate were prepared daily for the consumption of the Emperor's household.

The planting of the trees by the Aztecs was accompanied by a festival and a special ceremony in which the blood of some animal was sprinkled on the ground, that usually employed being from a dog having a spot of chocolate color.

*One of a Series of Popular Lectures given at the Philadelphia College of Pharmacy and Science, Season of 1923-1924.

As the fragrance and comfort of the drink permeates one, a series of pictures come. One sees Antonio Carletti, in 1606, a lover of chocolate, learning the method of manufacturing, teaching it to Italian friends and passing it on to the French and other European nations, but it is hard to picture chocolate as being considered a means of influencing the passions and to realize that even the much read *Spectator* in 1712 would appear with an article warning the public not to use it during the great carnival.

One sees the students at Oxford, as early as 1650 sitting together and discussing their problems over their cups of coffee and chocolate and finally in 1659 a monopoly being granted for the making and selling of chocolate in France.

All chocolate originally came from Central America but in 1679 came the first crop from a French Colony in Martinique, and its cultivation was begun in the Philippine Islands in 1680. Its main production today is in cultivated territory, distant from its origin.

Fruit on Cacao Tree.

During all of these earlier periods the cost of chocolate was necessarily high, yet there are many references to its use and great popularity, notably in connection with the "Chocolate Houses" of England where, in 1820, duty was paid on about 280 pounds of imported chocolate.

In those days the total production of the cacao bean was small compared with the present estimated annual world output, which exceeds four hundred million pounds.

Can anything be lovelier than the cacao tree, with its tall, slender trunk, often twenty-five feet in height, its small bright red flowers, springing from the main branches or from the trunk itself and, as in most tropical plants, the flowers and fruits, in various stages of growth, being found simultaneously upon the same tree. The fruit requires about four months to become mature and during this time changes from green to yellow and finally to a rich, golden red, when ripe, producing a striking color effect.

The cacao bean from which chocolate is made is a seed from a peculiar fruit or pod growing by a slender stem from the trunk or larger branches. Botanically, the cacao tree was named in 1720 by Linneaus "Theobroma Cacao," signifying "Food of the Gods." Possibly in selecting this title he was influenced by treatise on Chocolate by Buchot, a French physician, written in 1684, in which he described chocolate, "As an invention more worthy of being called food of the gods than nectar or ambrosia."

Longitudinal and Cross-Section of Pods, Showing the Arrangement of the Cocoa Beans or Seeds.

Several other species of the genus Theobroma have been cultivated but the "Theobroma Cacao" supplies by far the larger proportion of the beans.

Even the picture of a cacao plantation is most attractive. The trees are planted regularly, about twenty feet apart, in rich, loamy soil, where the temperature remains between 69 and 89 F. throughout the year. It is necessary that there should be ample moisture but good drainage. As the trees do not thrive in too great heat it is necessary to plant other trees which will shade the cacao tree. Imagine the ideal spot on which to found a cacao plantation being a well-sheltered vale, covered with large trees, protected by mountain spurs from prevailing winds, well watered, and yet well drained, with a good depth of deposit of decayed alluvial soil, on which rests a thick vegetable matter, easy of access, and in a district distant from lagoons or marshes, for the proprietor's health.

These ideal conditions have been found in Mexico, in Costa Rica, in the islands of the West Indies, in Ceylon, and in certain parts of Africa.

The trees begin to bear fruit when three or four years old and

if well cared for will produce regular crops for fifty or more years.

The fruit is cut and gathered when ripe, usually twice a year, a hand knife, or, for the higher branches, a knife on a bamboo pole being used.

It is said that great care is necessary in cutting the fruit that the blossoms may not be injured since the new flowers are usually found at the point where the fruit joins the tree.

The fruit resembles a large cucumber, being from 8 to 10 inches in length with ridged sides. The shell is about a half-inch thick and contains a white, sweetish pulp, not unlike a canteloupe and encloses from twenty to forty almond-shaped seeds which when properly cured represent the "Cacao beans" of commerce.

Harvesting the Cocoa Pod.

When the outer shells have been broken or cut and the seeds and pulp removed it is difficult to separate the pulp and this is usually brought about by fermentation, in specially constructed houses. The seeds are placed in vats and fermentation proceeds under regulated temperatures until completed. The practical planter, recognizing the proper condition and color. The ultimate flavor and value largely depends upon the skill with which this process has been conducted. From nine to twelve days are required for fermentation and curing, the beans changing during the process from almost white to a rich brown, with extensive chemical modification such as the conversion of starch to soluble dextrin, the hydrolizing of the astringent matter, which is largely reduced, and the loss of some alkaloid. Treatment with alkali has been proposed instead of fermentation but the latter process, when properly controlled, still produces the finest flavor in the beans.

When the proper color and flavor has been developed by fermentation, the beans are usually washed and then dried as quickly as possible, preferably by exposure on large trays to the heat of the sun. Drying is sometimes done artificially.

The very names of the chief commercial sources of the cacao bean are imagination appealing. Think of Ecuador, Venezuela Surinam, Brazil, Cuba, Haiti, San Domingo, British Guinana, British Honduras, Nicaragua, Colombia, Mexico, Gautemala, Trinidad, Granada, Guadeloups, Martinique, St. Lucia, Dominica, St. Vincent, and Jamaica. In Central America and the West Indies. San-Thorme, Cameron, Gold Coast and Fernando Po in Africa, and the islands of Java, and Ceylon.*

Cutting Open Pods to Obtain the Beans.

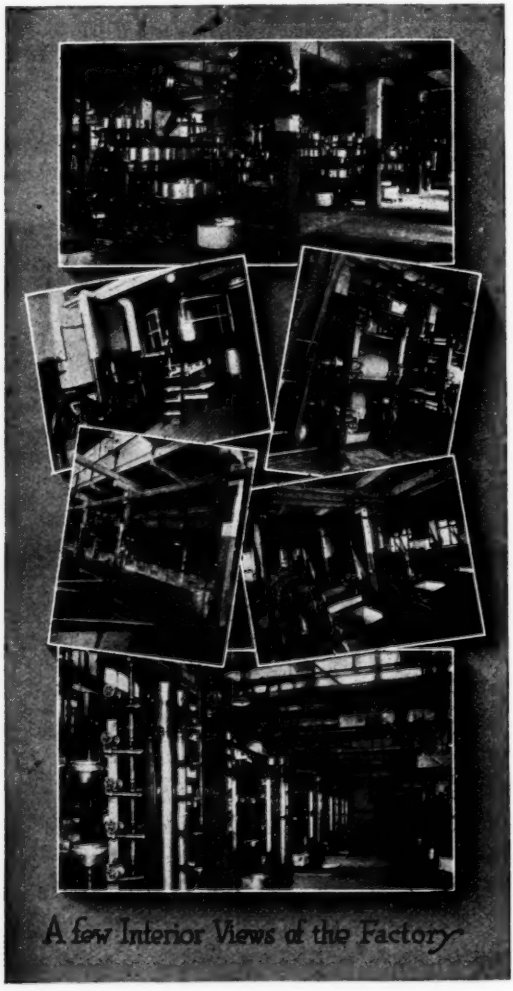
A marked variation will be found in the quality of beans from different countries and also in the several grades obtainable in any one market.

The best grade comes from selected stock, and must be correctly fermented, quickly washed and carefully dried to avoid moulds. Sometimes the beans are "clayed" (covered with a reddish clay), notably is this true in Trinidad, the claim being made that the clay prevents insect attack.

In many other varieties the beans are "polished" by dancing on

*Approximate production in 1917: In South America: Ecuador, 40,000 tons; Venezuela, 20,000 tons; Surinam, 3000 tons; Brazil, 55,000 tons. In Central America small quantities from Guatemala, Mexico and Costa Rica. In the West Indies: Haiti, 2000 tons; San Domingo, 24,000 tons; Trinidad, 31,000 tons; Granada, 5000 tons; Jamaica, 3000 tons; Guadeloups, 1000 tons; Martinique, 500 tons; Lominica, 300 tons; St. Vincent, 100 tons. In Africa: San-Thomé, 30,000 tons; Cameron, 4000 tons; Samoa, 1000 tons; Gold Coast (Acera), 90,000 tons; Fernando Po, 3500 tons; Nigeria, 15,500 tons; Ceylon 3600 tons; and smaller amounts from Java, Celebes, Temate, Aruboina, Sumatra and Baili.

the dried beans, thus removing adhering pulp. If the beans are clayed, or improperly cleaned, there is considerable loss in weight due to impurities and their subsequent removal. The beans should be brittle, easily crushed and the kernels or "nibs" readily separable from the shells.


A few Interior Views of the Factory

An expert can readily determine the quality or grade of beans by examining, smelling and tasting them.

Even the chemist will get a picture from the analysis of the kernels of cacao beans, which show about 40 per cent. of fat, and about 1.37 per cent. of theobromine. The latter is an alkaloid similar chemically and in physiologic action to caffeine, the alkaloid from tea and coffee.

The husks or shells also contain theobromine, about 0.62 per cent., and this is the commercial source of theobromine.

A part of the skill of the manufacturer of chocolate consists in his ability to properly blend the cacao beans from various sources to secure the desired flavor. The beans, which are marketed in large sacks, holding about 250 pounds must first

be cleaned. In this process, sticks, stones, clay, pieces of clothes, and other foreign substances, are removed. The beans are then roasted, very much as coffee is roasted, to develop the aroma, modify the color, oxidize some of the tannin, and make it possible to readily remove the husk. The roasting is conducted in revolving drums at a temperature between 100 and 135 C., the process being continued until the desired effect is obtained. When the beans have acquired the proper flavor, they must be quickly cooled to prevent further change caused by contained heat. This is accomplished by transferring them to a cooler so arranged that cold air can be blown through the mass of beans.

The beans are now passed through rollers to crack the husk and kernel and then winnowed, or subjected to a blast of air, to separate the broken kernels, now technically called "nibs," from the shells, the modern machines affecting almost complete separation.

A germ-separating machine is also an important piece of apparatus since the presence of the germ lessens the value of the finished chocolate as it is slightly bitter and extremely gritty when ground.

The "nibs" are now ground through a series of heavy mills to reduce them to the finest possible subdivision and smoothness, even the best grades being greatly lessened in value if not finely enough ground.

A few moments after the nibs pass under the rollers they melt to a thick dark liquor due to the heat of friction liquefying the oil which constitutes about half the weight of the beans.

After passing through several grinding stones (most manufacturers object to iron or steel mills), the "chocolate liquor" may now be placed in hydraulic presses and much of the oil removed, about 18 per cent. remaining in the pressed cake. This cake when powdered constitutes the "Cocoa" of the market and when treated with alkali produces the so-called "soluble cocoas."

Most cocoa beverages are made from this powdered cocoa.

The oil which separates as a clear liquid solidifies at the ordinary temperature and constitutes Cacao Butter or "Coco Butter," which enters into many toilet preparations for application to the face and hands and forms the base for most suppositories. Cacao butter may also be obtained from the roasted or unroasted beans by the use of volatile solvents.

Chocolate liquor of higher grade is not pressed to remove the fat but will be further ground in heavy mills until free from all harshness, then conditioned by heating for some hours at about 130 degrees Fahrenheit, and finally treated for special application.

Sometimes powdered or evaporated milk is added to produce "milk chocolate." Again sugar and vanilla may be used to make "sweet chocolate" or nuts to produce "chocolate almonds," etc.

The chocolate liquor so prepared is usually moulded into the commercial forms such as cakes, bars, "buds," etc., and must be suitably wrapped or boxed for sale.

A special chocolate liquor is prepared for coating candy, a process which calls for an exact temperature and consistence at the time of coating, which long experience alone can provide.

A word should be added concerning the food value of chocolate. This remarkable substance is not only a confection, although it is one of the most delightful of candies. It is more than this, however, it contains such large amounts of fat that it becomes one of the most valuable nutritive foods and the alkaloid theobromine adds its stimulating and refreshing qualities. This well explains the reason why soldiers, arctic explorers and others exposed to the rigors of a campaign or exploration, provide themselves with an abundance of this highly concentrated food which is also a gratification and pleasure to consume.

It will thus be seen that in this remarkable substance, Chocolate, nature has almost excelled its many other lavish gifts by providing an ideal food, a delicious drink, the perfect confection, and a medicine to stimulate without doing harm.

Would one believe it possible to find all these pictures in a cup of chocolate? Perhaps they will come to you with your next cup of the fragrant drink.

SOMETHING ABOUT GASES.*

By Frank X. Moerk.

Of the three states of aggregation in which matter presents itself to us, namely, solids, liquids and gases, the last are characterized by an exceeding mobility so that definite volumes cannot be spoken of unless the gases be confined; they are exceedingly sensitive to

*One of a Series of Popular Lectures given at the Philadelphia College of Pharmacy and Science, 1923-1924 season.

changes in temperature and pressure, a decrease in temperature or an increase in pressure causing a decrease in volume, and an increase in temperature or a decrease in pressure causing an increase in volume. These effects are noted uniformly with all gases and only as they approach the stage of liquefaction are some irregularities noticed.

Vapors differ from gases in that they can, by a decrease of temperature, be reconverted into liquids or solids from which they were originally obtained.

Air is undoubtedly the most important gas because necessary for respiration and combustion; the proper explanation for these phenomena, however, was not forthcoming until 1777, not one hundred and fifty years ago.

A brief presentation of the development of our knowledge of gases should be of interest: In the sixth century B. C., Anaximenes and Heraklit considered air to be the elementary substance from which all other substances could be obtained.

Empedokles, about 440 B. C. viewed air, water, earth and fire as the fundamental materials; Agricola did not believe these to be fundamental substances but represented different properties of one fundamental substance. Wind, in some very ancient writings, is given instead of air.

As chemistry slowly developed during succeeding centuries, gases were evolved in chemical experiments, which are now known as hydrogen, carbon dioxide, etc., but which were then considered to be modifications of air; inflammable gases, as hydrogen and methane and gases not supporting combustion, as carbon dioxide, were confused with each other.

Philippus Aureolus Paracelsus (1493-1543), produced an inflammable gas by action of acids upon iron.

Galileo Galilei (1564-1642), generally called Galileo, the noted physicist and astronomer in 1597 constructed the first thermometer based upon the expansion of air.

Jan Baptista von Helmont (1577-1644), was the first one to use the term gas and to distinguish between gases and vapors. He made a study of carbon dioxide (gas sylvestre), and recognized this gas found in the stomach, in mineral water, in caves, as also being produced in the alcoholic fermentation, by the burning of carbon and by the action of acids upon limestone and potashes; but confused it with other gases which did not support combustion. He consid-

ered hydrogen and methane as being peculiar forms of gases. The difficulty in collecting gases accounts for many of his incomplete observations and it will be noted that the gases mentioned are not very soluble in aqueous solutions.

Evangelista Torricelli (1608-1647), produced the Torricellian vacuum in 1643 and found that the atmospheric pressure sustained a volume of mercury about thirty inches in height, equal to nearly fifteen pounds per square inch.

Otto von Guericke (1602-1686), discovered the air pump about 1650 and with the Magdeburg hemispheres carried out some startling experiments.

Robert Boyle (1626-1691), improved the air pump in 1659 and, by exhausting the air surrounding a barometer, proved that the height of the mercury column was due to atmospheric pressure. In 1660 he discovered the law that the volume of a gas was inversely as the pressure.

Edme Mariotte (1620-1684), in 1676 discovered the same law regarding the effect of pressure upon volumes of gases.

John Mayow (1645-1679), in 1669 stated that the air contains a substance which combines with heated metals forming calces (metallic oxides), which sustains respiration, which changes venous into arterial blood; the same substance is stated as being present in saltpeter. He devised methods for the collection and examination of gases.

Stephen Hales (1677-1761), made many improvements in the apparatus for generating and collecting gases, separating the evolution and receiving vessels. The apparatus was used by Black, Priestley and others and developed into the apparatus in use at the present time.

Gabriel Daniel Fahrenheit (1686-1736), about 1714 introduced the use of mercury for thermometers and from his experiments thought he had obtained absolute zero when the thermometer was immersed in a mixture of ice and salt; the volume of mercury employed expanded from 11,124 parts immersed in ice and salt to 11,156 parts at the melting point of ice and to 11,336 parts at the temperature of boiling water, giving the three important divisions on his scale, 0, 32 and 212.

Renè Antoine Ferchault de Reamur (1683-1757), about 1731 proposed his thermometric scale: melting point of ice = 0 and boiling point of water = 80.

Anders Celsius (1701-1744), about 1742 introduced the scientific thermometric scale known as the Celsius or centrigrade scale: melting point of ice = 0 and boiling point of water = 100.

Joseph Black (1728-1799), discovered latent heat in 1762; and determined that of water to be 140 degrees F. and that of steam to be 810 degrees F.; he also discovered specific heat; in heating limestone and magnesium carbonate he noted that a loss in weight was sustained due to the escape of a gas having the same properties as the "gas sylvestre" of Helmont and which, as it combined with the alkalies and lime, he called "fixed air"; he prepared caustic alkalies by treatment of mild alkalies (carbonates), with lime or magnesia. In 1767 he publicly demonstrated that a suitable vessel filled with hydrogen would ascend in the air as cork does in water.

James Watt (1736-1819), a friend of Black, in redetermining the latent heat of steam noted 950 degrees F. and utilized this in his work on the steam engine about 1765.

Henry Cavendish (1731-1810), in 1766 announced hydrogen, which he called "inflammable air," as a peculiar gas differing from other gases; in 1781 that water consisted of oxygen and hydrogen; in 1783 that air was a mixture of oxygen and nitrogen of constant composition, averaging 20.85 per cent. oxygen (at the present time 20.9 per cent. is accepted), determined by explosion with hydrogen; and that nitric acid could be produced from a mixture of oxygen and nitrogen by a spark discharge and also noted that a small residue of gas 1/120 of the amount of air started with, could not be made to combine with oxygen (first mention of inert gases other than nitrogen, in the air).

Joseph Priestley (1733-1804), prepared and examined many gases of which little was known; invented the pneumatic trough (1770), and the mercury seal for collecting gases; as a result he discovered gases which are soluble in water, as ammonia, hydrogen chloride, sulphur dioxide and silicon fluoride (the latter had undoubtedly been prepared before but collected over water decomposed and gave rise to hydrofluosilicic acid). His greatest discovery, 1774, was the isolation of oxygen, "dephlogisticated air," by heating mercuric oxide and while aware of its stimulating influence upon burning bodies and also upon respiration he failed to properly interpret combustion processes although shrewd enough to note the part that oxygen played in animal and vegetable life. He found that oxygen combined with nitrogen dioxide and that the oxygen content of air

varied between 18 and 25 per cent.; and that one-fifth of the volume of air was convertible into carbon dioxide, the remaining gas (nitrogen), was called "phlogisticated air."

Karl Wilhelm Scheele (1742-1787), in 1774 independently of Priestley, discovered oxygen, "fire-air," by heating mercuric oxide, black oxide of manganese, also other oxides and saltpeter. He also noticed that it increased combustion and respiration, and that the burning of a light in a confined volume of air produced as much carbon dioxide as oxygen disappeared. Scheele used ferrous hydroxide, moist ferrous sulphide and phosphorus for absorbing oxygen and arrived at the same volume percentage as Priestley. He was the first one to clearly point out that air contained a second constituent incapable of supporting respiration and combustion. He discovered chlorine in 1774 and hydrogen sulphide in 1777.

Daniel Rutherford (1749-1819), isolated nitrogen in 1772 by absorbing the carbon dioxide produced by respiration or combustion and announced the residual gas, which did not support respiration or combustion, as an atmospheric constituent.

Anton Laurent Lavoisier (1743-1794), had the master mind to correctly interpret the processes of respiration and combustion in 1777 and thus settle the controversy which engaged chemists during a century. Later he divided the known chemicals into elemental and compound substances and gave names to the elements indicating some chemical or physical property, names which have never been changed.

Humphrey Davy (1778-1829), was engaged in 1795 in a heroic task, namely, to test, by inhalations the action of gases as remedial agents; among those tried were nitrogen monoxide (afterwards used by dentists for anæsthesia and more recently in major operations), nitrogen monoxide and alcohol, higher oxides of nitrogen, methane and carbon dioxide; in 1815 invented the safety lamp, a devise to prevent the explosion of mixtures of inflammable gases and air. He suggested the use of liquefied gases as means of generating power and for the preservation of food.

John Dalton (1766-1844), was early interested in the physical properties of gases, notably the expansion by heat and their absorption in liquids. His investigations on the chemical composition of gases led to the law of multiple proportions in 1802; thus he found that if, instead of expressing results as usual in terms of percentage, a special weight be adopted as a unit the analysis of ethylene would

show twice as much carbon as methane, and carbon dioxide twice as much oxygen as carbon monoxide, etc. Dalton observed that the composition of the atmosphere was independent of the altitude and that the constancy was not due to simply mechanical agitation but due to diffusion as he proved by experiments that heavy gases diffused upward into lighter ones, while the latter diffused downward even though very narrow tubes. He faithfully kept a daily record of the weather and allied phenomena from 1787 to the very day of his death, a record embodying no less than 200,000 separate observations.

Joseph Louis Gay-Lussac (1778-1850), established laws relating to the volume combination of gases and discovered the relationship of volumes of gases as dependent upon temperature (1802), confirming the observations made by J. A. C. Charles about 1787. Gases at 0 degrees C. were found to expand 1/273 of their volume for an increase of 1 degree C. and to contract 1/273 for a decrease of 1 degree C.; from this law was calculated that absolute zero on the centigrade scale would be recorded as —273 degrees C. The Boyle-Mariotte law in connection with the Gay-Lussac and Charles law enabled reliable measurement of volumes of gases and calculation to standard conditions, namely, 0 degrees C., and atmospheric pressure at sea-level or 760 mm.

Gay-Lussac and Jean Baptista Biot (1774-1862), on August 24, 1804, ascended in a balloon equipped for making observations; as some doubt was expressed as to the accuracy of the observations, Gay-Lussac, on September 16, 1804, made another ascension, reaching an altitude of 23,000 feet, the highest attained up to that time; the barometer fell to 12.6 inches and the temperature from 31 degrees F. to —9.5 degrees F. These results confirmed those previously obtained. A bottle of air collected at this height, upon analysis, gave the same oxygen and nitrogen content as air collected at the surface of the earth.

Liquefaction of Gases.

Michael Faraday (1794-1867), devoted part of his energy to the liquefaction of gases; the experiments were carried out by generating and heating the gases in sealed, bent glass tubes and in many cases liquefaction resulted through the pressure produced by the heat; in later experiments one limb of the glass tube was cooled by immersion in a freezing mixture while the other was heated and this

method resulted in liquefying gases which withstood the first method. Explosions were frequent and many accidents occurred even with the safeguard of a glass-mask. The first gas liquefied was chlorine but Faraday gave credit to Thomas Northmore, who had liquefied it about 1805 by use of a pressure pump and gauge; other gases liquefied included sulphur dioxide, hydrogen sulphide, carbon dioxide, nitrogen monoxide, cyanogen, hydrogen chloride and ammonia; in

Gay-Lussac and Biot making their balloon ascension for scientific observations in 1804.

connection with the last he found that 100 grains of silver chloride absorbed 130 cubic inches of ammonia and when this compound was heated in a sealed tube the ammonia was again liberated and liquefied without trouble. All of this work was accomplished in 1823.

M. Bussy, in 1824 first used liquefied sulphur dioxide under reduced pressure, thereby hastening the evaporation of the sulphur

dioxide, to produce lower temperatures than that of the liquefied gas and succeeded by this method in liquefying chlorine, ammonia and cyanogen.

M. Thilorier, in 1834, prepared liquefied and solidified carbon dioxide on a large scale and noted that a mixture of liquefied carbon dioxide and ether under reduced pressure enabled —110 degrees C. to be attained.

Faraday, in 1845, resumed his work on the liquefaction of gases and by employing two pumps and Thilorier's freezing mixture, solid carbon dioxide and ether, succeeded in easily liquefying and, in most cases, solidifying the gases experimented with in 1823 but failed in liquefying hydrogen and oxygen at 27 atmospheres, nitrogen and nitrogen dioxide at 50 atmospheres, carbon monoxide at 40 atmospheres and coal gas at 32 atmospheres. The freezing mixture of solid carbon dioxide and ether gave a temperature directly of —76.7 degrees C. and by placing the mixture under an air pump and exhausting to 1/26 atmosphere the temperature was reduced to —110 degrees C.; this low temperature could be maintained only for fifteen minutes; the gases solidified were: sulphur dioxide, hydrogen sulphide, nitrogen monoxide, hydrogen bromide, hydrogen iodide and ammonia. Faraday proclaimed liquefied nitrogen monoxide as the refrigerant of the future and J. Natterer in the same year, 1845, produced it on a large scale.

The low temperatures produced by the rapid evaporation of liquefied gases were not satisfactorily recorded by mercury and alcohol thermometers in use for registering natural temperatures, so thermometers containing carbon disulphide, phosphorus trichloride, air and hydrogen were used; later electrical resistance was utilized: in the thermo-electrical thermometer a resistance of 0.0001 volt indicated 1 degree C. and in the platinum-resistance thermometers a sensitiveness of 0.001 degree C. was reached.

During Faraday's time a large number of scientists became interested in the liquefaction of gases and by applying the methods of producing low temperatures just stated and subjecting the cooled gases to immense pressure the number of gases which resisted liquefaction was gradually reduced and the following, which resisted all attempts, were called permanent gases: hydrogen, oxygen, nitrogen (air), carbon monoxide, nitrogen dioxide and methane.

Johann Wolfgang Döbereiner (1780-1849), of philosopher's lamp fame, in 1825 accidentally discovered the very rapid diffusion

of hydrogen by noting that a cracked jar filled with hydrogen and standing in a pneumatic trough showed an increasingly higher water level inside the jar and explained this with the statement that the hydrogen passed out faster through the crack than the air could enter.

Thomas Graham (1805-1869), began in 1829 the study of the diffusion of gases which culminated in the discovery of the law that the rate of diffusion of gases is inversely proportional to the square root of the density.

Thomas Andrews, about 1862, discovered what is known as the critical temperature and critical pressure. Gases at a temperature above the critical temperature cannot be liquefied no matter how great the pressure: this explains the failures of J. Natterer in liquefying the permanent gases at the enormous pressure of 3000 to 4000 atmospheres (pressures exceeding that of exploding powder in cannons). The critical pressure is the pressure needed to liquefy a gas at its critical temperature. This work of Andrews led to renewed efforts in liquefying the permanent gases.

Louis Paul Cailletet and Raoul Pictet in December, 1877, within a few days of each other, succeeded in liquefying oxygen. The gas subjected to intense cold and pressure (320 atmospheres), failed to liquefy but upon releasing the pressure greater cold was produced by the expansion of the gas and some of the oxygen was liquefied. Pictet cooled the gas by liquid sulphur dioxide to —25 degrees C. and then by liquid carbon dioxide to —140 degrees C.; Cailletet used liquid carbon dioxide, nitrogen monoxide and ethylene and attained —136 degrees C., lowered by releasing the pressure to —200 degrees C. Pictet also liquefied hydrogen (1878), and Cailletet acetylene, nitrogen dioxide, carbon monoxide, nitrogen, hydrogen and methane (1881); the last was suggested as the refrigerant of the future.

Sigmund Wroblewski and Karl Olszewski in 1883 liquefied oxygen, nitrogen and carbon monoxide and, later, air and hydrogen, using for the last boiling oxygen as the refrigerant, for the others liquid carbon dioxide and ethylene. Oxygen liquefied at —130 degrees C., and 20 atmospheres, nitrogen and carbon monoxide at —136 degrees C., and 150 atmospheres; oxygen was liquefied in sufficient quantity to transfer it from one vessel to another. All the permanent gases were liquefied and nitrogen, nitrogen dioxide, carbon monoxide and

methane solidified. Wroblewski predicted in 1884 that liquid air would be the refrigerant of the future.

James Dewar, by using liquid nitrogen monoxide, cooled liquid ethylene to —90 degrees C., and by forcing the evaporation of the latter attained —145 degrees C., to which temperature oxygen, under a pressure of 50 atmospheres, was cooled causing its liquefaction; in draining off the liquid oxygen at this pressure about 90 per cent. was lost. Air and other gases were liquefied in a similar manner. Later air and oxygen under 150 atmospheres pressure were cooled by liquid carbon dioxide to —79 degrees C., and after fifteen minutes drops of the liquefied gases could be collected and as much as 100 cc. obtained in one operation; in this process the compressed gas by release of pressure furnished some of the cold to cause its own liquefaction.

To prevent the rapid evaporation of liquefied gases, Dewar constructed special flasks consisting of double or treble walled glass vessels, forming two or three bulbs, with a Torricellian vacuum between the bulbs; by an ingenious treatment with liquid air the mercury vapor filling this vacuum was condensed and either partly or entirely removed before sealing the outer bulbs. The inner bulb in which the liquefied gases are stored is therefore protected by the most complete vacuum known. The calculated pressure of mercury vapor at 0 degrees C. is expressed as 0.000126 millimeters pressure or one six-millionth of an atmosphere (an atmosphere equals 760 millimeters); experiments show that a Torricellian vacuum of twenty liters capacity contains two milligrams mercury and if the mercury vapor in this vacuum be condensed by liquid air the pressure of the remaining mercury is reduced to 0.00000003 millimeters or two and a half millionths of a millionth of an atmosphere.

The Dewar flasks can be further improved by silver coating the outside of the bulb in which the liquefied gas is stored; this metallic surface will reflect radiant heat which alone can pass through the vacuum. Instead of the silver coating a very small amount of mercury can be left in the space between the inner and its surrounding bulb which at ordinary temperature will form a vapor and be invisible but when liquefied gases are placed in the inner bulb the mercury will condense and form a metallic coating on the outside surface of the inner bulb.

When liquefied gases are placed in these flasks some of the liquid passes into the gaseous condition with further decrease of tempera-

ture and the space above the liquid is filled with the intensely cold gas which prevents contact with the warmer air; between the liquid and the walls of the container there forms a thin film of gas preventing actual contact between the liquid and the container, in other words acting as a cushion. This is the so-called "spheroidai state" and allows the handling of these intensely cold liquids without danger; if the liquid were to come in direct contact with the skin severe burns would result.

Dewar and Moissan in 1897 liquefied fluorine, by use of liquefied oxygen, at a temperature of —187 degrees C., but did not succeed in solidifying it at —210 degrees C.

In 1898 Dewar obtained liquefied hydrogen in quantity by cooling the gas to —205 degrees C., under a pressure of 180 atmospheres and allowing the compressed gas to escape from the nozzle of a coil of pipe at the rate of 10-15 cubic feet per minute into a vacuum vessel kept at —200 degrees C.; drops of liquefied hydrogen soon appeared and 20 cubic centimeters collected in five minutes when the jet closed due to frozen impurities. One per cent. of the gas had been collected as liquid.

Liquefied air is turbid due to particles of solidified carbon dioxide, which gas is present in small quantity in the air; liquefied oxygen is turbid if the oxygen be made from potassium chlorate due to the presence of a little chlorine.

Liquefied air and oxygen can be solidified by cooling with a jet of liquid hydrogen. Dewar found helium to be the extent of 0.12 volume in 100 volumes of gas obtained from the water of King's Well in Bath, England; from 70 liters of this gas he obtained about 20 cc. which could not be liquefied and which consisted of practically equal volumes of nitrogen and helium; the liquefied gas was nitrogen. Helium was liquefied by the cold of liquid hydrogen, but could not be liquefied by the use of liquid air.

If a tube containing air be sealed and one end immersed in liquefied hydrogen for one minute, the air will solidify and separate in the lower part of the tube; if the glass of the tube be then softened by means of a blow-pipe, above the liquid hydrogen the atmospheric pressure will seal the tube and produce a vacuum tube without the aid of a pump or apparatus of similar function. A more easily solidified gas could be used for filling the tube and liquid air used instead of liquid hydrogen. Sir William Crookes, an authority on high vacua, found a higher vacuum in these tubes than in tubes made by exhausting for several hours with a mercury pump.

Liquefaction of Air on a Commercial Scale.

The work so far recorded in the liquefaction of what had been called "permanent gases" was accomplished by disregarding expense of installation, the latter including the costly liquefied gases which by rapid evaporation produced low temperatures to cool the gas to be liquefied and this cooled gas then by release of pressure produced a still lower temperature with liquefaction of part of the gas. In some of Dewar's work 10-15 cubic feet of hydrogen cooled under pressure were allowed to escape per minute producing one per cent. of liquefied hydrogen; some idea of this lavish use of hydrogen can be obtained by recalling that an ordinary gas burner delivers five cubic feet of gas per hour.

A number of experimenters took up the problem of producing liquefied air on a large scale; prominent in this field were Trippler, Linde and Hampson, who independently of each other succeeded in solving the problem by using compressors either with or without water as the cooling agent.

The air is subjected to a pressure of 80 to 170 atmospheres and the gas which becomes heated during the compression is cooled by water; it next passes into a liquefier, a long cylindrical container, carefully insulated, containing a long coil of pipe closed at the bottom by a valve and a receptacle for the storing of the liquefied gas with a valve for the withdrawal of the liquefied gas. The cooled compressed gas is allowed to escape through the valve into the space outside the coil; this release of pressure allows the compressed gas to expand and in doing this it is further cooled; after escaping from the coil it must travel upward and therefore it cools the descending gas in the coil, and when this escapes from the valve it will be at a still lower temperature. This additional cooling of the compressed air continues until the temperature is so lowered that under the pressure employed some of the air is liquefied and collects in the provided receptacle, from which it can be removed without much loss as it is not stored under great pressure.

In some modifications of the described process there may be two or three coils of pipe inside each other and made of thin metal so that changes of temperature will be rapidly conveyed from one coil to the other. Using two coils the compressed gas passes down the inner coil and the expanded cooler gas passes upward through the outer coil. Using three coils the compressed gas passes down the inner coil and after expansion a portion, which can be regulated,

passes up the middle coil to cool the descending gas, the balance passes up the outer coil and acts as an insulation. A vacuum pump may be part of the apparatus to more rapidly expand the gas as it leaves the inner coil.

Trippler produced from 3-4 gallons liquid air per hour and has sent it in milk cans, insulated by a covering of felt, to distant points.

Linde prepared per hour about 3 quarts liquid air containing about 70 per cent. oxygen.

Hampson produced 1.2 quarts of liquid air per hour; in making liquid oxygen from compressed oxygen gas, the apparatus is first cooled with liquefied carbon dioxide.

Liquid air in a test tube, under reduced pressure, boils and the tube becomes coated with snow from the moisture in the atmosphere; later, liquefied air drops from the bottom of the tube, showing that the temperature produced by the rapid boiling of liquefied air is capable of liquefying air.

Trippler has used liquefied air to crystallize and purify chloroform and alcohol; the latter solidifies at —130 degrees C.

Liquid air boils at —192 degrees C. and as nitrogen boils at —195.7 degrees C. and oxygen at —182 degrees C. the nitrogen will escape first with a little oxygen, leaving oxygen either pure or mixed with some nitrogen, depending upon conditions.

Rarer Constituents of the Atmosphere.

Cavendish noted that in sparking a mixture of air and oxygen a residual gas was always obtained amounting to about 1/120 of the volume of air taken.

Rayleigh in 1893 found a discrepancy in the weight of a liter of nitrogen obtained from the air and nitrogen obtained from some of its chemical compounds, the former weighing 1.25718 gms., the latter 1.2507 gms.; or expressed in terms of specific gravity, the former 0.97209, the latter 0.96737.

While nitrogen as an element was considered to be inert, it could be made to combine with oxygen with the aid of the electric spark, also with magnesium at higher temperatures, producing mag-

nesium nitride; by these methods Rayleigh and Ramsay obtained from atmospheric nitrogen a more inert gas and called it "argon."

In 1895 Ramsay made an investigation of the gas obtained by heating the mineral, cleveite, which, owing to its inertness had been considered to be nitrogen; the nitrogen was removed by heating with magnesium and the residual gas which did not combine with magnesium was found to be helium, an element discovered in 1868 in the sun's atmosphere. Later helium was found in other minerals, in gases obtained from some mineral springs and, more recently, in larger quantity in natural gas from wells in the southern and southwestern states.

The discovery of these two gases and their placement in the periodic system suggested that there must exist other gases belonging to the same group; by the evaporation of large quantities of liquid air three other gases, helium, neon and xenon were discovered and by the evaporation of crude argon, a fifth gas, krypton, was discovered. In the detection of these gases the examination of the spark spectra was of great value; the vacuum tubes of Dewar made by use of liquid hydrogen, gave the spark spectra of hydrogen, neon, helium and carbon (the last attributed to carbonates in the glass).

These rare gases make up less than one per cent. by volume of the atmosphere, and the individual quantities may be stated as follows:

One	volume	argon	is	present	in	107	volumes	of	air.
"	"	neon	"	"	"	81,000	"	"	"
"	"	helium	"	"	"	250,000	"	"	"
"	"	krypton	"	"	"	20,000,000	"	"	"
"	"	xenon	"	"	"	40,000,000	"	"	"

They form a group of inert gases and have resisted all efforts made to combine them with other elements.

In 1903 Ramsay and Soddy, in a study of the radium emanations, discovered a gas which was named "niton" and found that it belonged to the group of inert gases; niton, kept in glass tubes for a few days, disappeared and helium appeared in its place constituting the first record of the transmutation of an element.

	Critical Temperature °C	Critical Pressure Atmospheres	Boiling Point °C	Solidifying Point °C	Other Conditions for Liquefaction
Argon	—122.4	47.9	—186.9		
Helium	—267.8	2.75	—269		
Krypton	— 62.5	54.3	—151		
Neon	—213	29	—248	Liquid Hydrogen	
Niton	+104.5	62.5	— 62		
Xenon	+ 16.6	58.2	—109		
Acetylene	+ 36.5	61.6	— 85	— 81	15 C°, 83 Atm.
Air	—140	39	—192	Liquid Hydrogen	
Ammonia	+130	115	— 33.5	— 77	—40° C; +10° C, 6-7 Atm.
Carbon Dioxide	+ 31.1	73	— 78.2	— 56	0° C, 35 Atm.
Carbon Monoxide	—141.1	35.9	—190	—211	
Chlorine	+146	93.5	— 33.6		—34° C; +12.5° C, 8.5 Atm.
Ethylene	+ 10	51.7	—102	—169	
Hydrogen	—243	19.4	—252.8		
Hydrogen Chloride	+ 52.3	86		—116	+10° C, 40 Atm.
Hydrogen Oxide (Water)	+365	196.4	+100	0	
Hydrogen Sulphide	+100	88.7	— 62	— 83	17 Atm.
Methane	— 95.5	50	—164	—186	
Nitrogen	—146	35	—195.7	—211	
Nitrogen Dioxide	— 93.5	71.2	—154	—167	
Nitrogen Monoxide	+ 38.8	77.5	— 89.8	—102	—88° C; 0° C, 30 Atm.
Oxygen	—113	50.7	—182.9	—252	
Ozone			—106		
Sulphur Dioxide	+155.4	78.9	— 10	— 76	—18° C; —10° C, 3 Atm.

Composition and Uses of Air.

Collected from various parts of the globe, high or low altitudes, air has practically a constant composition; of course there will be variations if the samples be taken from places where large quantities of oxygen are consumed for respiration and other forms of combustion, as the use of fuel for heat and power, the manufacture of sulphuric acid from sulphur or metallic sulphides, the extraction of gold and silver by the cupellation process, etc., or in places where other gases may be produced in quantity and allowed to escape into the air, as near lime kilns, blast furnaces, etc.

The vastness of the air supply is shown by a calculation published some years ago which was based upon a daily consumption of 20 cu. ft. of oxygen by a grown person while the oxygen for animals and for all other oxidation purposes was taken as nine times the amount allowed for mankind; at this rate it would require 1300

years to show a decrease of 0.1 volume per cent. in the oxygen content of the air.

The constancy of the composition of the air is maintained by cycles of changes involving both the animal and vegetable kingdoms. Animals require oxygen to free the blood from impurities, thereby changing venous into arterial blood; the gaseous product, carbon dioxide, is exhaled while liquid and solid products of oxidation are eliminated through the skin, kidneys and alimentary canal. Plants take up the carbon dioxide and exhale oxygen. Nitrogen is also required by plants, but atmospheric nitrogen must first be made assimilable and this is accomplished by electric discharge or by certain bacteria; some of the plants may go as food to the animal kingdom and both plants and animals after death and decay will again yield nitrogen going into the air or other nitrogenous products going into the soil.

The analysis of dry air free from carbon dioxide shows the following percentages:

By Volume: Nitrogen 78.06, Oxygen 21.00, Argon 0.94.
By Weight: " 75.50, " 23.20, " 1.30.
Helium, Hydrogen, Krypton, Neon and Xenon in Traces Only.

The *carbon dioxide* content of air is about 4 parts in 10,000 parts (by volume). Air is necessary for respiration and combustion; a person exhales about 0.6 cu. ft. of carbon dioxide per hour and as the content of this gas in living rooms should be kept below 7 parts in 10,000 parts, it is necessary to supply each person with 1800 cu. ft. of fresh air per hour; in using fuels for heat or power the following quantities of air are necessary: coal, per pound, 200 cu. ft.; oil, per gallon (fuel, kerosene or gasoline), 1866 cu. ft.; natural gas, per cu. ft., 9-10 cu. ft.; manufactured gas, per cu. ft., 4-5 cu. ft. A large ocean steamer is stated to pour out of her funnels about a ton of carbon dioxide per minute.

If the products of combustion are not passed into a flue or chimney, good ventilation must be provided, otherwise quantities of carbon dioxide dangerous to life will accumulate. With an insufficent supply of air, the carbon of the fuel will be imperfectly oxidized producing the much more poisonous carbon monoxide. Deaths have frequently resulted from furnace gases because of an insufficient air supply; since the introduction of the automobile, and the storage of the same in the usually small garage with its limited

air supply, quite a number of deaths have been recorded due to attempted repairs in the closed garage while the engine was kept running. It may be well to here emphasize the fact that carbon, either as coal or coke or as present in fuel oils, will burn in excess of air to form carbon dioxide and then, as the oxygen diminishes, take away half the oxygen from the carbon dioxide, producing the deadly blood-poison, carbon monoxide; victims of this poisonous gas probably never realize their danger. These statements should emphasize the importance of ventilation.

Water vapor is the one air constituent which is most variable in amount, the quantity depending upon the temperature, but averaging a little less than 1 per cent. by volume. 1800 cu. ft. of air, perfectly saturated with water vapor (100 per cent. humidity), at 25 degrees C. (77 degrees F.), contain almost 2.5 pints of water; upon cooling to 0 degrees C. (32 degrees F.), the air will show 100 per cent. humidity, for this temperature, but will contain only about 0.6 pint of water, the difference between the 2.5 pints and 0.6 pint being precipitated as rain. Water vapor is lighter than air, therefore, the more water vapor present the lower the barometer reading and a falling barometer is one of the signs of approaching rain. A proper humidity is essential for the comfort of man (or beast); ordinarily air is saturated with water vapor to the extent of 50-70 per cent.; if the humidity is greater the air is damp and sultry; on the other hand, if less it is uncomfortably dry. During the summer months when the humidity is naturally higher, electric fans and artificial cooling will add comfort; during the winter months when the humidity is low and artificial heating is necessary for an agreeable indoor temperature the uncomfortable dryness can be remedied by the evaporation of sufficient water to increase the humidity and thereby prevent many of the throat and lung troubles so prevalent during this period.

It is customary during the winter to maintain, as near as possible, a temperature of 70 degrees F. (21.1 degrees C.), in living apartments, but with the proper humidity 68 degrees F. (20 degrees C.), is found comfortable. The 1800 cu. ft. of fresh air, stated before as necessary to keep the carbon dioxide within desirable limits, to register 100 per cent. humidity, must contain about 1.9 pints of water; the proper humidity at 20 degrees C. is 40 per cent. and this means that 0.76 pint of water will have to be evaporated every hour, or for a family of five people about 0.5 gallon of water.

Uses of air in which no change in composition is evolved.

(1) The propagation of sound waves upon which depends speech, music, telephone, phonograph, radio transmission and reception, alarm clocks and other forms of signals; (2) the use of compressed air in automobile tires, in pneumatic drilling tools, in air brakes, in sand-blasts for cleaning brick and stone buildings, for mechanical etching of glass, for enforced draught, for separating chaff from grain, for drying as in dental work, etc.; (3) the use of so-called vacuum cleaners, in which air currents pick up and carry dust and other light particles, like saw dust, into a receptacle from which the air can escape and in which the collected solids are deposited, in cupping and in the use of breast and stomach pumps (forms of suction pumps) atmospheric pressure forces liquids and solids into a receptacle in which a vacuum has been produced by heat or a pump; (4) the use of air as a condensing or cooling agent as seen in the immense metallic structures extending into the air and constituting an important part of ice and of liquefied gas plants, also seen on a less pretentious scale in the recovery of constituents of higher boiling point in the refining of petroleum, etc., and utilized for preventing excessive heating of motors and automobile engines.

Uses of air depending upon the oxygen content.

(1) Respiration, previously explained. (2) Fuel combustion for heat and power; in addition to statements already made, the terms, calorie (ca) and British thermal unit (B. t. u.) may be explained as they are so frequently used in expressing the value of fuels; the calorie represents a heat unit which will raise the temperature of one gram of water 1 degree C. and the calorific value of solid and liquid fuels is an expression of the number of grams of water which can be raised 1 degree C. by the burning of one gram of the fuel; the "British thermal unit," on the other hand, represents the number of pounds of water which can be raised 1 degree F. by the burning of one pound of fuel; calories can be converted into B. t. units by multiplying by 1.8 and B. t. units can be changed into calories by dividing by 1.8; in the case of gaseous fuels the value is expressed in calories per cubic foot, which may be converted into B. t. units by multiplying by 3.97, the reverse conversion by dividing by 3.97. Another method of expressing the value

of fuel gives the weight of water at the boiling point which can be converted into steam of the same temperature as 536 calories or 965 B. t. units (536 x 1.8), are required for this change in condition, the calorific value in calories divided by 536 will give kilograms of water at 100 degrees C., which can be changed into steam at 100 degrees C.; or the calorific value in B. t. units divided by 965 will give pounds of water at 212 degrees F., which can be converted into steam at 212 degrees F. If the water be below the boiling point less can be vaporized by the same weight of fuel; thus starting with water at 40 degrees C., the divisor would be 536 plus (100-40) or 596; or starting with water at 80 degrees F., the divisor would be 965 plus (212-80) or 1097. (3) Illumination: with the exception of the electric light bulb, all other forms of illuminants require oxygen, the value of the illuminant being expressed in terms of "candle-power" and has reference to a sperm candle burning 120 grains per hour. The illuminants in use at the present time are kerosene, gas and electricity; illuminating gas used as a source of heat and light varies considerably in composition depending upon its source:

	Coal Gas	Water Gas	Carburetted Water Gas
Illuminants	5%	0.0%	16.6%
Methane	34.5	1.0	19.8
Hydrogen	49.0	36.0	32.1
Carbon Monoxide	7.2	51.0	26.1
Nitrogen	3.2	7.0	2.4
Carbon Dioxide	1.1	4.0	2.4

Especial attention is called to the poisonous carbon monoxide content.

The greatest advance in the use of gas for illumination was due to the invention and perfection of the Welsbach mantle, in which a nonluminous but hot flame could become a luminous flame by heating certain metallic oxides (cerium and thorium), to incandescence; the candle power of a gas being raised to as high as 50, in comparison with 12-18 as given by the usual gas. (4) The drying of paints in which the linseed oil by taking up oxygen changes into the varnish-like film offering protection to wood and metal; of the metals, iron is the most important for structural, roofing and other uses but exposed to moist air it oxidized (rusts), becoming

pitted and perforated; to retard this weakening effect, iron is coated with tin (tin-plate), zinc (galvanized iron), and copper, but even this protection is not permanent and requires painting. Zinc and copper, therefore, are used to replace iron for some purposes and being only superficially changed by the oxygen and carbon dioxide in the air to basic carbonates, zinc turning white and copper green. (5) The manufacture of sulphuric acid: Sulphur and metallic sulphides on heating will combine with oxygen producing sulphur dioxide and this in the presence of oxides of nitrogen or catalytic agents will combine with more oxygen producing sulphur trioxide which with water or steam gives sulphuric acid. (6) In the extraction of gold and silver by the cupellation process an alloy of the precious metals with lead is obtained which by heating in air leaves the gold and silver while the lead forms a fusible lead oxide the last traces being absorbed in a bone-ash cupel. (7) The action of air depending upon oxygen as its active constituent, numerous methods have been proposed and used for extracting oxygen from the air; the method, superseding all others depends upon the property of liquefied air first giving off nitrogen leaving oxygen of various degrees of purity depending upon the yield. In using air in combustions the 80 per cent. inert nitrogen absorbs considerable heat; proper mixtures of oxygen with hydrogen or illuminating gas, more recently with acetylene gas are used for the generation of intense heat; one gram hydrogen burning in oxygen will develop 34,200 calories, one gram carbon in the same way 8080 calories; the temperature of the oxy-hydrogen flame is given from 2100 degrees to 2500 degrees C., that of the oxy-acetylene flame or torch as 2500 degrees C. (8) Ozone, a very active form of oxygen, produced to the extent of about 6 per cent. when the silent electric discharge is passed through air or oxygen; one part of ozone per million parts of air determines the difference between tolerable and intolerable conditions with a limited air supply; used in ventilation and water purification, in bleaching, deodorizing and oxidizing oils; important in cold storage of foods, suppressing the deleterious changes noted when the temperature rises above the critical point. (9) Atmospheric nitrogen can readily be prepared by a number of processes in which the oxygen is made to combine with other substances under proper conditions; thus by passing air over heated metallic copper; by burning carbon, sulphur or phosphorus in a confined volume of air; by agitating air with an alkaline suspension

of ferrous or manganous hydroxides or with an alkaline solution of pyrogallol; when other gases are produced as in the burning of carbon and sulphur, these can be removed by the addition of an alkali.

The fixation of atmospheric nitrogen rendering it available for fertilizer and other uses can be accomplished yielding several products: (a) Calcium nitrate, or nitric acid. Air, passed through a special furnace heated to 3500 degrees C. by arc flames produced from an alternating current of 5000 volts, leaves the furnace containing about 2 per cent. nitrogen dioxide which upon rapid cooling combines with more oxygen forming nitrogen tetroxide and absorbed in water will finally yield a 50 per cent. nitric acid; the gas not absorbed by water is passed over slaked lime yielding an additional quantity of calcium nitrate into which compound the nitric acid is also converted and prepared for the market as fused calcium nitrate. This can be used as fertilizer or used for the preparation of nitric acid. (b) Calcium cyanamide. Calcium carbide, a product of the electric furnace, if heated in such a furnace to 2000 degrees C. will absorb nitrogen from a current of air producing calcium cyanamide, also called "nitro-lime," useful as a direct fertilizer (20 per cent. nitrogen), or by fusion with alkalies yields cyanides. (c) Ammonia can be synthethized by passing a mixture of 3 volumes hydrogen and 1 volume nitrogen at 500 degrees C. and 150 atmospheres pressure over a catalyzer, an iron-uranium alloy; may also be made by action of superheated steam upon calcium cyanamide or magnesium nitride. (d) Nitric Acid. Ammonia gas with 10 volumes air rapidly passed over an electrically heated catalytic agent as platinum gauze or pure iron activated with metals like bismuth, copper, tungsten, etc., can be oxidized to nitric acid.

The methods used for the separation of the rarer atmospheric gases have been given in a previous section.

Next will be considered a few cases where air must be excluded: (1) Barometers. The space above the mercury (Torricellian vacuum), must be perfectly free from air to prevent inaccuracies in graduation. (2) Mercury thermometers. Made by boiling the mercury in the thermometer tube, sealing and graduating, their use is limited to the temperatures between the freezing and boiling point, —40 degrees C. and 350 degrees C.; but if the space above the mercury be filled with gases under pressure much higher temperatures can be recorded, the limit being the temperature at which the

glass softens. Thermometers made of Jena glass and the space above the mercury filled with nitrogen can be used for temperatures as high as 550 degrees C.

(3) Vacuum tubes. These are made for different purposes and in various designs; Geissler tubes, used to show the effect of rarified gases upon electrical discharges of high tension, pressure in these is reduced to 0.76 mm. mercury. Crookes tubes to show cathode discharge or X-rays, pressure reduced to 0.000760 mm. mercury. Electric light bulbs, these contain a fine filament of tungsten which by the passing of the current becomes white-hot, in the presence of air (oxygen), the filament would oxidize and break the current; for some years these tubes represented the most perfect vacuum but are now surpassed by the radio tube; in more recent forms of electric light bulbs nitrogen and argon are used. Neon tubes are used to test the ignition in automobile engines, an orange glow showing an electric current and the brightness of the glow the relative quantity. Radio tubes used as detectors and amplifiers contain a filament made of platinum-iridium alloy coated with oxides of barium and strontium; the filament is heated by a low voltage (1-6) current; the exhaustion of the air by pumps is effected while the tube is heated, the pressure being reduced to 0.000001 mm. mercury; radio tubes are spoken of as hard and soft, the former containing the more perfect vacuum. To emphasize the figures given in connection with these vacuum tubes it may be well to recall that the atmospheric pressure is equal to 760 mm. mercury. Vacuum tubes are now used as essential parts in apparatus for examining the action of the heart and for recording various forms of deafness and correction of this affliction. (4) Thermos bottles represent a practical application of the Dewar flasks.

(5) In preserving and canning food products air is removed by boiling the material, filling the heated containers and sealing; in addition to removing air, boiling sterilizes the product, meaning thereby the destruction of bacteria which are present in the air and which may be on the material to be preserved; imperfect sterilization is indicated in the case of material stored in glass jars by gas bubbles below the surface of the material, in the case of canned goods by a bulging of the metal or by the escape of gas when the can is opened. It should be needless to say that such goods should not be eaten.

Refrigeration.

Very closely connected with the last subject is the preservation of food by reducing the temperature. Probably the most ancient method is found in the cooling of water, by placing it in an unglazed earthenware container and setting this in a shady place; the water penetrating the container is converted by air currents into water-vapor, a change requiring heat which is furnished by the water in the container with a lowering of temperature. The old-time spring house cooled by spring water and in which were kept milk, butter and other victuals. The use of ice, which in melting takes up heat from surrounding objects, is now the consumers' method of keeping foods in good condition; but manufacturers and large dealers have installed refrigerating plants controlled automatically so that the desired temperature is readily maintained. The principle employed in these installations depends upon the facts that gases by pressure and cooling are liquefied with evolution of heat, the latter removed by air or water cooling; upon releasing the pressure the liquid passes into the gaseous condition by abstracting heat from surrounding objects thereby producing cold; this cycle repeats itself, regulated by the automatic control. There are two methods of utilizing the lowering of the temperature, in the so-called direct method, the cold gas circulates through pipes in the container, room or building to be cooled; in the indirect method the cold gas circulates in pipes placed in a tank containing a brine, either sodium or calcium chloride, and this cooled brine then circulates through the space to be cooled. The liquefied gases used on a large scale are ammonia and carbon dioxide; the former used in buildings, the latter preferably on ships. Within the past few years small installations to be used in the household have appeared; the tank containing the brine being placed in the refrigerator, the condensing pump and motor in a convenient closet; liquefied sulphur dioxide is most generally used and forms are provided which filled with water and lowered in the brine will yield small cubes of ice.

Combustible and Non-Combustible Gases.

1. Combustible: Acetylene, carbon monoxide, ethylene, hydrogen, hydrogen sulphide, illuminating gas, methane.
2. Non-combustible: Ammonia, carbon dioxide, carbon oxychloride, chlorine, sulphur dioxide, nitrogen, and the rarer atmospheric gases.
3. Supporters of combustion: air, oxygen, nitrogen monoxide.

The combustible gases will burn in air or oxygen; if quantities of these gases be mixed with air or oxygen and a flame brought near the mixture or an electric spark produced near the mixture dangerous explosions and fires may follow. Where are such mixtures possible? Illuminatng gas and air: leaks in pipes or open stopcocks; we have all read of people looking for a gas leak with a lighted candle; acetylene and oxygen: in the use of the oxy-acetylene torch in an unventilated place if the gases are turned on before lighting the acetylene, or if the flame should be extinguished and allowed to flow some time before relighting; hydrogen and oxygen: the oxy-hydrogen blow-pipe under the same conditions as oxy-acetylene torch; the charging of storage batteries gives this mixture in its most effective proportions and looking into the storage batteries with the aid of a flame to see what is doing is on par with the hunter for the gas leak; carbon monoxide and air: putting coal on a fire without sufficient draught is often followed by the stove door being blown open, if the gas has escaped into the cellar do not look for it with a flame; this mixture may also be produced by running the automobile engine in a closed garage and then allowing air to enter; methane and air: the dreaded "fire damp" of the coal miner set off by a light or spark. Davy's safety lamp does not prevent small explosions taking place within the metallic gauze enclosing the lamp proper, but will prevent the flame from coming in contact with the dangerous mixture outside of the gauze.

There may be explosions due to other causes: many of the liquefied gases are stored under heavy pressure; should the container give way, the sudden liberation of a large volume of gas may be dangerous; the gradual formation of gases in a confined space may result finally in an explosion, this may happen in saccharine liquids containing an insufficient amount of sugar to prevent fermentation due to the formation of carbon dioxide, as in the fermentation of one ounce of cane-sugar about 17 pints of carbon dioxide will be produced; boiler explosions due to water coming in contact with red-hot tubes, 1 cu. inch water producing 1696 cu. inches of steam.

Fire Extinguishers.

These generally depend upon the liberation of considerable volumes of non-combustible gases, preferably heavier than air so as to envelope the substance on fire and prevent access of air. Among the chemicals used are sodium bicarbonate mixed, when

needed, with sufficient sulphuric acid so that the liberated carbon dioxide will force the mixture out of the container. Sodium thiosulphate liberates sulphur dioxide; ammonium sulphate liberates nitrogen and sulphur dioxide. Carbon tetrachloride, a non-inflammable liquid, is much in use forming a very heavy vapor but which when hot produces with water a poisonous gas, carbon oxy-chloride.

Poisonous Gases.

This group includes: Illuminating gas, carbon monoxide, carbon dioxide, nitrogen, ammonia, chlorine and sulphur dioxide; the last two are used for bleaching, the former for cotton, the latter for wool.

Medicinal Gases.

Oxygen is used to keep up respiration during critical stages; ozone as a sterilizing agent and for purifying air and water.

Nitrogen monoxide, alone or mixed with oxygen, liquified air and ethylene are used as anæsthetics.

Carbon Dioxide.

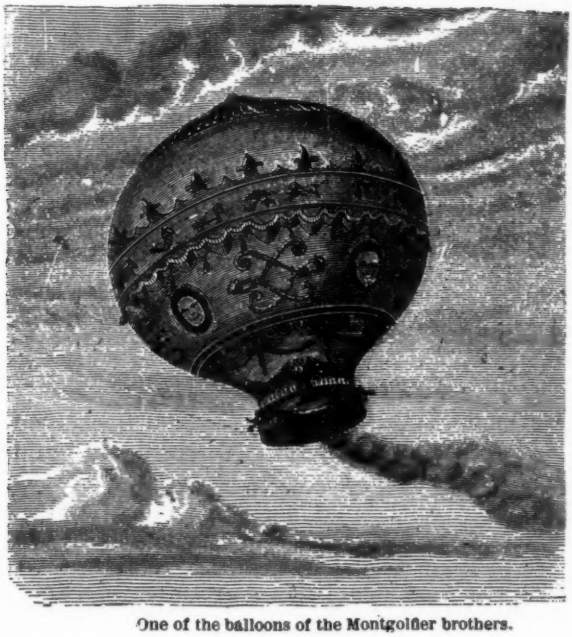
While this gas introduced into the lungs does not support respiration and therefore is grouped among the poisonous gases, if taken into the stomach it is found very agreeable. This explains the extensive use of carbonated beverages and effervescent mixtures. The so-called "soda water" is water impregnated under pressure with the gas; under a pressure of five atmospheres five volumes of the gas are held in solution, but upon release of the pressure the major part of the gas escapes with effervescence.

Carbon dioxide obtained from various sources plays an important part in baking; introduced into the dough the gas bubbles in trying to escape, especially during the baking, bring about the characteristic cellular structure of bread and cake. The carbon dioxide may be added: as ammonium carbonate which is decomposed by heat into ammonia and carbon dioxide, both gases are driven out in the baking; as yeast which in causing the fermentation of sugar produces alcohol and carbon dioxide both expelled in baking; lastly, as baking powder, containing generally three constituents: a filling material as starch or flour, the second constituent always sodium bicarbonate and finally, the third constituent, acid in character, acting upon the sodium bicarbonate liberating carbon dioxide, may be one of the following chemicals: tartaric acid, cream of tartar, calcium

superphosphate, mono-sodium phosphate or alum or aluminum sulphate; sometimes several of these last constituents are present in a baking powder. The criterion of a sample of good baking powder depends upon the percentage of available carbon dioxide which it yields upon the addition of water and the purity of the chemicals employed.

Hydrogenation of Oils.

Oils and fats consist of mixtures of liquid and solid constituents; the liquid constituents belong to the class of unsaturated organic compounds and can be made in the presence of nickel as a catalytic agent, to take up hydrogen and change into a saturated organic compound, solid instead of liquid. This change can be effected with many edible oils thereby changing them into fats.



One of the balloons of the Montgolfier brothers.

Balloons.

The first balloon sent up by the Montgolfier brothers at Ammonay in 1783; the ascensional force was furnished by burning chipped straw and wool saturated with alcohol. On August 27, 1783, a balloon of less than 600 cu. ft. capacity filled with hydro-

gen, was sent up in Paris; the populace were so excited over this appearance in the sky that, after descending, the balloon was torn into shreds; the French Government then issued a statement to the people extolling the possible benefits that might result from their use. In November, 1783, another ascension was made in which human freight was carried for the first time, two Frenchmen, De Rozier and D'Arlandes. August 24, 1804, Gay-Lussac and Biot made the first scientific observations in a balloon. September 6, 1804, Gay-Lussac made another ascension reaching an altitude of 23,000 feet at which altitude the barometer registered 12.6 inches with a temperature of —9.5 degrees F.; the temperature before starting was 31 degrees F.; the time required for the trip was six hours and distance covered ninety miles. In 1859, Wise, LaMountain, Gager and Hyde ascended from St. Louis, Mo., and in less than twenty hours descended at Henderson, N. Y., a distance of 1150 miles, averaging fifty-seven miles per hour.

Hydrogen and later illuminating gas, both inflammable and explosive with air, were used; these were recently replaced by helium, not as light as hydrogen, but noninflammable and nonexplosive; the Shenandoah, our largest aircraft, has a capacity of two million cubic feet.

Utilization of Waste Gases.

In the early days of the chemical industries many products were allowed to escape into the air causing destruction of vegetation in large areas. Many metallic sulphides were roasted and the sulphur dioxide allowed to escape; this gas is now converted into useful sulphuric acid. In making sodium carbonate, sulphuric acid acting upon sodium chloride produced the needed sodium sulphate while hydrochloric acid gas was allowed to escape, causing so much damage that legal enactments were adopted preventing this procedure, the result was such an accumulation of commercial hydrochloric acid that some outlet had to be found for it and this led to its use in making chlorine which converted into bleaching powder gave a commercial outlet. In the manufacture of coke for iron furnaces, illuminating gas and other products were not collected but at the present time there is saved the gas, ammonia, and coal tar yielding many salable products. In operations where combustible gases are produced these are utilized as fuel.

NOTES ON SOME TESTS FOR METHANOL.

Henry Leffmann.

The detection of methanol has been the subject of much investigation. It has become a very important problem of late years. The most comprehensive review of the literature and procedures recently published is that by LaWall, in *Trans. Wagner Free Inst. of Science*, 1923, Vol. 10. This contribution was republished in this journal (1923, *95*, 812). LaWall's investigations led to a modification of the standard process (based on oxidation to formaldehyde by acid permanganate in the cold), and in the form into which he developed it, the procedure is delicate and trustworthy. He, however, found that glycerol will simulate the reaction, and that, therefore, distillation must be employed in all cases, as small amounts of glycerol are generally produced during the alcoholic fermentation. The reagent commonly used for the detection of the formaldehyde is that known as Schiff's, a solution of fuchsin decolorized with sulphurous acid in the presence of hydrochloric acid. E. Wertheim (*JACS*, 1922, *44*, 1834) described another method of preparing the reagent as follows: 0.005 gram of rosanilin hydrochloride are dissolved, with warming, in about 75 cc. of water, the solution cooled quickly, 6 grams of sodium hydrosulphite ($Na_2S_2O_4$) dissolved and made up to 300 cc. The liquid is ready for use at once. This is a delicate reagent for a number of aldehydes, including formaldehyde and acetaldehyde. It is, however, unsuited for use in the methanol test noted above, as the strongly acid liquid which is obtained in that procedure promptly decomposes the sodium hydrosulphite, forming a thick cloud. Wertheim's modification does not appear to be as delicate as the original Schiff's solution, but he claims that it can be used by heating the liquid, a property that has, however, no important practical value in routine testing for methanol. An experiment was made to determine whether any of the small amount of formaldehyde formed in the standard test could be separated by distillation. The amount of permanganate taken is such that not more than 30 milligrams of formaldehyde can be formed. It was found that a distillation of the liquid after completing all the details, except adding the fuchsin solution, gave a distillate in which Schiff's solution gave a faint but distinct tint, indicating that some of the formaldehyde had distilled. A portion of the distillate was also tested with Wertheim's modified solution,

but no color appeared. The liquid, however, did not appear milky, due probably to the fact that no appreciable amount of acid distilled over. Inasmuch as the acids present are mainly phosphoric, sulphuric and oxalic—if any of the latter remains—it is not likely that any portion will distil.

Orcinol (a dihydroxytoluene) has lately come into use as a test for methanol, depending on a reaction with formaldehyde. James B. Sumner (*JACS*, 1923, *45*, 2378) has investigated the test, and gives the following procedure, which he has found very delicate and trustworthy. The following solutions are required:

Potassium dichromate	6.7%
Sulphuric acid	62.0%
Orcinol	0.5%

Sumner has found that test-tubes with scratches are apt to give misleading results, and as part of the test depends of removing acetaldehyde by heating, he recommends a tube 2.5 cm. in diameter. In such a tube place 1 cc. of the liquid to be tested, add 2 cc. of the dichromate solution and 2 cc. of the sulphuric acid. Mix and allow to stand for about 10 minutes. The reduction to blue chromic sulphate should occur in about 40 seconds. If it takes longer the alcohol is too dilute. After about ten minutes add 15 cc. of water, mix well, and heat for 10 minutes in boiling water. This is to distil off the acetaldehyde. Now add 1 cc. of the orcinol solution and again immerse in boiling water. If the sample contains more than 5 per cent. of methanol the liquid will become turbid in 5 minutes; with 1 per cent. about 15 minutes may be required, and with much smaller amounts longer heating.

Glycerol simulates the test, hence as in the case of the standard test, distillation is necessary when testing commercial samples.

Sumner's method was carried out by me and found to give entirely satisfactory results on a sample containing a very small amount of pure methanol with considerable ethanol, and a negative result was obtained from the ethanol itself. I do not find the procedure as convenient as that with permanganate, but it will be of much value as a confirmatory test in forensic cases. The orcinol used was from the Eastman laboratories. The presence of acetone in considerable amount in commercial methanol, especially in that which is required for denaturing spirits under the present law, renders the salicyl aldehyde and vanillin tests available for detec-

tion. As little as 0.1 per cent. of commercial methanol can be detected by adding to about 10 cc. of the sample, a few cc. of a 5 per cent. solution of salicyl aldehyde or vanillin in dilute alcohol and dropping in a fragment of sodium hydroxide A red ring appears above the alkaline solution. The reaction with vanillin is quite distinct but is slower and not quite so pronounced as that with the salicyl aldehyde.

EFFICIENCY OF SOME ORGANIC DYES AS ANTI-FERMENTS.

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Within recent years considerable work has been done toward establishing various organic dyes as antiseptics. This paper records experiments performed with the object of extending the research into the allied field of anti-ferments by determining quantitatively the action of several dyes on yeast.

The method is identical with that originated by Harvey [1] [2] for the purpose of studying the action of a number of common anti-ferments. Briefly, the method consists in dissolving 114.4 grams of cane sugar in sufficient distilled water to make 1000 cc. To this solution is added 12 grams of fresh compressed yeast and the liquid divided at once into 50 cc. portions. One portion is used as the control. To each of the other portions is added 5 cc. of a 1 per cent. aqueous solution of the dye. Every hour the solutions are filtered until clear and polarized in a 100 mm. tube. The filtered portions are used to wash back the residue left on the filter, thus keeping the reacting materials constant.

The method is based on the fact that yeast gradually hydrolyzes dextro-rotatory sucrose to equal parts of dextrose and levulose, the reaction being followed by the change in hourly polariscopic readings. The scale readings are plotted as ordinates and time as abscissas and, since the control solution gives the normal curve, if curves for the solutions containing anti-ferments are com-

[1] Amer. Jour. Pharm., Vol. 94, No. 12, 797-801.
[2] Amer. Jour. Pharm., Vol. 95, No. 2, 105-108.

pared to it, it will be seen that the more efficient the anti-ferment the less the action of the yeast and hence the smaller the changes in hourly readings. In other word, the efficiency of the anti-ferment varies inversely as the change in readings.

Most of the dyes investigated are commonly used as stains, and a number have been investigated as bactericides, as a perusal of the appended bibliography will disclose.

Dye	Original	End 1st hour	End 2d hour	End 3d hour	End 4th hour	End 5th hour	End 6th hour	End 7th hour	End 8th hour
Safranine	20	17.6	15.8	14.5	13.5	12.7	11.8	11.1	10.5
Nitro phenol, para	20	17.1	15.5	14.0	13.0	12.1	11.5	10.9	10.3
Methylene blue.	20	16.9	15.0	13.4	12.0	10.6	9.6	8.6	8.0
Eosin Y	20	16.4	13.0	10.5	9.3	8.3	7.5	6.6	5.9
Aniline violet (methyl) ...	20	17.6	15.6	13.6	11.6	9.8	8.0	6.4	4.8
Cyanine	20	17.8	15.7	13.6	11.6	9.5	7.5	5.5	3.4
Acid fuchsin ..	20	16.4	12.6	10.0	7.5	5.5	4.1	3.5	3.0
Alizarine blue S	20	14.5	11.5	9.0	7.0	5.0	3.0	1.3	0.0
Control	20	15.5	11.3	8.2	6.0	4.4	3.1	1.9	0.9

On account of the high tinctorial power of Methylene blue, Cyanine and Acid fuchsin it was impossible to polarize the original solutions in 100 mm. tubes. These solutions were diluted and calculated back to the 100 mm. tube basis. A 100-watt lamp with a reflector was used as the source of light.

From the table above it is seen that the dyes tested have a varying range of anti-ferment value, Safranine heading the list with considerable retarding action, and Alizarine Blue S footing the table with apparently a slight accelerating action.

Since conditions in this and the preceding papers have been kept constant, it is possible to make comparisons of the anti-ferment value of the dyes with chemicals more frequently used for that purpose.

It was found that mercuric chloride killed the yeast almost at once and was the most efficient anti-ferment found. Assuming the efficiency to be 100 per cent., a table may be prepared in which all the anti-ferments examined by this method may be compared

and referred to a common standard. On this basis, and taking the reading at the end of the eighth hour as the basis of calculation, the following table shows the results obtained to date:

RELATIVE EFFICIENCY OF VARIOUS ANTI-FERMENTS.

Chemical	Percentage Efficiency
Mercuric chloride	100.0
Potassium cyanide	99.4
Sodium hypochlorite	97.2
Ultra violet rays	91.8
Sodium arsenate	78.1
Hydrogen peroxide	77.6
Methyl salicylate	71.0
Salicylic acid	63.3
Cresol	62.3
Safranine	57.3
Nitro phenol, para	56.2
Furfural	54.6
Aluminum sulphate	54.6
Zinc sulphate	53.5
Sodium bisulphite	53.0
Methylene blue	43.7
Formaldehyde	40.4
Copper sulphate	38.8
Phenol	37.7
Benzoic acid	33.8
Nitro-benzol	33.3
Boric acid	33.3
Eosin Y	32.2
Oxalic acid	31.1
Abrastol	26.7
Aniline violet (methyl)	26.2
Sodium hydrosulphite	25.6
Benzaldehyde	24.0
Oil of birch	22.4
Saccharin	21.8
Oil of cloves	21.3
Oil of sassafras	20.2
Sodium fluoride	19.6
Cyanine	18.5
Acid fuchsin	16.3
Beta-naphthol	14.7
Alizarine blue S	00.0

Conclusions.

1. Utilizing the method described in two previous papers, the anti-ferment efficiency of eight organic dyes have been investigated.

2. At the concentration, and under the conditions described, all of the dyes examined, except Alizarine Blue S, showed some anti-ferment value, several ranking well up in the list with more commonly used chemicals.

3. A table is given in which all of the anti-ferments so far examined by this method have been computed to a percentage efficiency basis.

4. A bibliography of articles bearing on the use of dyes as bactericides is given.

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CHOCOLATE IN CHOCOLATE-COATED TABLETS AND PILLS.

By Edward S. Rose.

Is chocolate or cocoa used in the coating of the chocolate-coated tablets and pills found on the market? It is generally accepted by those who use these tablets that the brown color is actually chocolate. Indeed most large pharmaceutical houses place the words "chocolate coated" on the label.

Most pharmacists, however, and those closely connected with the tablet and pill industry know that very little chocolate is used. Several men whose vocation is tablet and pill coating have told the writer that chocolate is now but rarely used.

The main purpose of this paper is to give the results of the examination of twenty different lots of "chocolate-coated" tablets and pills, being the products of large pharmaceutical houses, of firms which supply physicians only, and of proprietary concerns. Tests were carried out to detect the presence of chocolate and iron. Whenever the word "chocolate" is used, it is understood to include cocoa which in fact is the material used in coating.

The following precipitation test was developed and used for the detection of chocolate.

Carefully remove the dark colored coating from 3-10 tablets or pills according to size by macerating in 10 cc. of warm water in a casserole, finally scraping with a knife if necessary. Make slightly acid to litmus with acetic acid, bring to the boiling point, cool somewhat, add 1 gm. of precipitated chalk, and filter as clear as possible through paper. Wash the casserole and residue on the filter with 15 cc. of warm water, discarding the filtrate; spread out the filter containing the residue on the side of the casserole and remove the contents with a spatula and wash filter with 5 cc. of water, after removing the filter paper, add 5 cc. of sodium carbonate solution to the mixture in the casserole, mix thoroughly, and boil gently on a sand bath for two minutes; allow to cool somewhat and filter as clear as possible through paper, washing the residue on the filter with 2 cc. of water. Discard the filter and residue. Pour the filtrate into a casserole, make slightly acid to litmus with acetic acid, add 3 cc. copper acetate solution, mix thoroughly

and pour into a 15 cc. centrifuge tube. Allow to stand 30 minutes and then whirl 2-3 minutes. For small amounts whirl again in about two hours. A brown flocculent precipitate indicates chocolate. If the test shows a very small amount of precipitate it is well to run another using more tablets or pills.

Reagent used in the above test:

Water is distilled water.

Sodium carbonate solution—Na_2CO_3 10 gm., water q. s. 100 cc.

Acetic acid—$HC_2H_3O_2$ (glacial, U. S. P.) 10 cc., water q. s. 100 cc.

Copper acetate solution—$Cu(C_2H_3O_2)_2H_2O$ 5 gm., $HC_2H_3O_2$ (glacial, U. S. P.) 1 cc., water q. s. 100 cc.

Coating materials such as ferric oxide, burnt umber, extract of glycyrrhiza, coal tar colors, chalk, cane sugar, glucose, gelatin, acacia, starch, etc., do not interfere with the above test. As small an amount as 5 mgm. of cocoa can be detected if allowed to stand several hours before centrifuging. The volume of precipitate from 10 mgm. of cocoa is usually 0.05-0.1 cc.

To determine the dependability of this test the writer examined a large number of mixtures containing 10 mgm. portions of cocoa and various combinations of the above coating materials, also the coating from tablets which was known to contain 2-3 per cent. of cocoa. In all cases positive results were obtained. A number of tests with the coating from tablets known to be free of cocoa gave negative results.

The following procedure was used for the detection of iron: Carefully remove the dark-colored coating from 1-4 tablets or pills by macerating in 3 cc. of warm distilled water in a casserole, scraping with a knife if necessary. Evaporate to dryness on a water bath, add 2 cc. each of concentrated HCl and diluted H_2SO_4 (U. S. P.), mix, add 0.5 gm. $KClO_3$, stir well and evaporate to dryness on a water bath under a hood. Next add to the residue in the casserole 3 cc. diluted H_2SO_4 (U. S. P.) and 5 cc. distilled water, mix well, and filter through paper, add to the filtrate a few drops of potassium ferrocyanide solution (U. S. P.), when iron will be indicated by an immediate dark blue color and subsequent precipitate.

RESULTS OF EXAMINATION.

Key to table below:

A—Number of firms represented.

B—Different lots of tablets or pills examined.

C—Labeled chocolate coated.

D—Chocolate present.

E—Chocolate present in outer coating.

F—Iron present.

TABLE.

Tablets or pills of	A	B	C	D	E	F
Large pharmaceutical houses	7	7	5	4	2	7
Firms supplying physicians only	5	5		1	1	5
Proprietary concerns	8	8		4	3	8

Comments:

All of the tablets and pills examined had coatings of a chocolate brown color, but less than one-half contained chocolate.

From the observations of these tests the writer approximately estimates the amount of chocolate present as less than 5 per cent. of the coating materials used.

Coal tar colors were used by some firms. Iron was present in all cases probably as ferric oxide brown or burnt umber.

The consuming public thinks it is taking products coated with chocolate, but, as a matter of fact, chocolate is either absent or if present is in very small amounts. It would be far nearer the truth to state on the label "coated a chocolate color."

Iowa City, Iowa.

REPORT OF THE SUB-COMMITTEE ON SYNTHETIC ORGANIC CHEMICALS.*

I. Acetylsalicylic Acid.

At the last annual meeting we reported in reference to incompatibilities that oxalic and cinnamic acid after one month showed no incompatibility and that the tests would be continued during the year.

*Read at the 1924 meeting of the Scientific Section of the American Drug Manufacturers' Association.

From the results obtained we came to the conclusion that no incompatibility exists between acetylsalicylic acid and cinnamic acid, and that we have no indication of any incompatibility of aspirin with oxalic acid. With oxalic acid it was found that the 1:1 mixture with acetylsalicylic acid gave no test for free salicylic acid with ferric alum although the aspirin used contained slightly in excess of .04 per cent. Apparently oxalic acid interferes with the sensitiveness of the test, similarly to the behavior of citric acid and citrates. There was, however, no pronounced increase in acetic acid odor, indicating that very little decomposition, if any, had taken place.

With a ratio of 5 grains aspirin to 0.1 grain of oxalic acid the color test apparently is not interfered with and it is reported that no increase in salicylic acid was found in the tablet after one year.

TABLE I.

STABILITY OF ASPIRIN IN PRESENCE OF CINNAMMIC AND OXALIC ACID.

Mixture	% Free Sal. Acid in Aspirin Used	% Free Sal. Acid in Mixture When Made	% Free Sal. Acid After 1 Mo.	% Free Sal. Acid After 13 Mos.	Reported by
5 grain Aspirin 0.1 grain Oxalic Acid	0.1	0.1	0.1	0.15 blank 0.15	F. W. Heyl
1 part Aspirin 1 part Oxalic Acid	0.4	Color Masked	Color Masked		J. Bebie
5 grain Aspirin 0.1 grain Cinnamic Acid	0.1	0.1	0.1	0.16 blank 0.15	F. W. Heyl
1 part Aspirin 1 part Cinnamic Acid	0.04	0.04	0.04 blank 0.04	—	J. Bebie

II. Assay of Silver-Protein Preparations.

"Report on Organic Chemicals," circular 350 of the Revision Committee of the U. S. P. was submitted to the membership for study and recommendations. In response criticism was received from two members regarding the proposed assay for silver-protein (circular 350, p. 1933), which latter is herewith quoted:

> "Weigh accurately about 2 gm. of Strong Silver-Protein and ignite it in a porcelain crucible until all the carbon is burned off. Transfer as much as possible of the residue into a beaker, add to the crucible 5 cc. of nitric acid, warm to dissolve any

adhering silver and transfer the solution into the beaker with the aid of a little water. Cover the beaker and heat on the water bath until all the metallic silver is dissolved, adding a little more nitric acid, if necessary. Filter into a flask, wash well the insoluble residue with water, cool and dilute with water, if necessary, to about 50-75 cc., add 2 cc. of sulphocyanate. Each cc. of tenth-normal ammonium sulphocyanate corresponds to 0.01079 gm. of silver."

Dr. Volwiler as well as Mr. Ritch advised that in presence of inorganic chlorides the above method is not satisfactory because some of the silver will be converted to silver chloride upon ignition and treatment with nitric acid of the silver-protein. This silver chloride is filtered off and rejected and the titration of the filtrate gives therefore too low results for silver.

To avoid the difficulty Mr. Ritch adds sulfuric acid in addition to the nitric acid to convert any silver chloride to silver sulfate and thereby keep all the silver in solution. Dr. Volwiler on the other hand recommends the following method:

"Weigh about 0.5 gm., boil gently in 800 cc. Kjeldahl flask with 5 cc. of sulfuric and 5 cc. of nitric acids until all NO_2 fumes are expelled. Cool, add 25 cc. of water, boil off the water and heat for half hour longer or until any AgCl present is decomposed. Cool and dilute with 50 cc. of water, cool and titrate with n/10 KCSN after adding 5 cc. of saturated ferric alum solution and 5 cc. of nitric acid."

A sample of commercial Protargin Mild (Argyn) was divided into three parts and analyzed according to the above three methods by three parties. The sample contained inorganic chlorides, and, was therefore a suitable material to establish whether or not the criticism of the proposed U. S. P. X. method is well founded. The results are given in Table II.

TABLE II.

ASSAY OF SILVER IN SILVER-PROTEIN.

No.	Method	% Silver Reported by A. L. Ritch	E. H. Volwiler	J. Bebie		Ave. result of the 3 Laboratories
1	U. S. P. X proposed	27.05	26.69	25.99	Ave. of 3 determinations	26.95
2	U. S. P. X Modified (addition of H_2SO_4)	27.84	——	26.06	Ave. of 2 determinations	
					5 cc. H_2SO_4 added and heated 45 min. on steam bath	
3	Method used in Abbott Laboratories	27.22	28.00	27.96	Ave. of 2 determinations	27.7

The results reported for the U. S. P. X. method are the lowest ones in every case. The average from the results of the three laboratories is 0.8 per cent. lower than by method No. 3. The highest results are reported in two cases by the method used in the Abbott Laboratories (No. 3), and in one case the highest result is reported from the modified U. S. P. method (No. 2). In regard to the latter procedure, Dr. Volwiler reports finding that the precipitate of silver chloride did not dissolve when the material was heated on the water bath but that very probably more satisfactory results could be obtained if the mixture were heated in a Kjeldahl flask at a higher temperature.

A similar experience with method No. 2 was made in our laboratory. A blank test was, therefore, made using 5 cc. conc. nitric acid, 5 cc. conc. sulfuric acid and 1 per cent. silver chloride (based on one gram sample). After heating this mixture for 45 minutes on the steam bath some of the silver chloride still remained, but after two hours on the steam bath the chloride was completely decomposed.

The results obtained permit the following conclusions:

(1) The U. S. P. X method for assay of silver-protein preparations is not reliable in presence of inorganic chlorides. Since chlorides are often present in colloidal silver preparations a change in method is desirable.

(2) The U. S. P. X method could probably be made satisfactory by addition of sulfuric acid and heating sufficiently long and high enough to decompose all of the silver chloride.

(3) Method (3) appears preferable to methods (1) and (2) on account of being simpler and less subject to experimental errors. The whole reaction and assay can be carried out in one container, whereas methods (1) and (2) involve two transfers from one container into another one, as well as a filtration.

In view of above, it is deemed advisable to recommend to the U. S. P. Revision Committee to substitute method No. 3 for the proposed U. S. P. X method for assay of silver-protein.

III. U. S. P. X Titles Proposed by Revision, Sub-Committee on Nomenclature.

In the December number of the *J. A. Ph. A.*, pages 1132-1135, Chairman DuMez, of the U. S. Revision Sub-committee on Nomenclature published a list of changes in titles which have been recommended by his committee for adoption.

The proposed changes from "Acetphenetidin" to "Acetophenetide" and from "Benzo Sulphinidum" and "Sodii Benzol Sulphinidum" to "Glusidum" and "Glusidum Soluble" have been submitted to the discussion and to a vote of our committee. Of the eight answers received, seven declared against the change of these titles and one member voted in favor of the change.

The majority of the committee is decidedly opposed to both of these changes for the following reasons:

Acetphenetidin is now a thoroughly established term with the medical and pharmaceutical profession. The proposed change to "Acetophenetide" is based on scientific considerations of nomenclature and while it is understood that such considerations are very desirable in establishing the titles of new products they are not considered sufficient to outweigh long established usage. It takes years to accustom the professions to changed names and any change is liable to result in confusion.

To bring the title in conformity with the modern chemical nomenclature is not of sufficient weight in this case to justify the recommendation of a change.

Benzo Sulphinidum and Sodii Benzo Sulphinidum: The recommendation of a change to "Glusidum" and "Glusidum Soluble" was made by the sub-committee on nomenclature because the titles are shorter and therefore more attractive to physicians and also because they are the official British titles for these substances. Those reasons do not seem to be sufficient to outweigh established usage and correct nomenclature. Benzo Sulphinidum is descriptive for the product, whereas "Glusidum" is a coined name and besides is not any too familiar in this country. Anglo-Saxon uniformity is, of course, desirable provided it can be secured by adopting the title which is most approriate. The above change does not seem to be in line with the policies of the U. S. Revision Committee, and, if Anglo-Saxon uniformity is an object, it should be attained in this case by changing the British title rather than the American one.

Three of our committee members voting against the change ad-

vised, that if any change is contemplated they would be in favor of the title "Saccharin" because it is the most widely known and the one most frequently employed. As you know, it is also the official title in the Japanese Pharmacopœia. The sub-committee on nomenclature had also given consideration to the adoption of the title "Saccharin," but was influenced against it by the arguments by the Bureau of Chemistry.

One member of our committee also inquires why the title Benzo Sulphinide is not changed to read "Benzo Sulfimide."

Cascara Sagrada: One of the members of our committee entered his objection to the proposed change of the name Cascara Sagrada to "Rhamnus Purshiana" "because Cascara Sagrada has been in use for such a long time and is so well known that it is doubtful whether it will be replaced to any extent by the suggested name."

The change from Rhamnus Purshiana to Cascara Sagrada was made in the ninth revision of the U. S. Pharmacopœia as being the universally used title and no good reason can be seen for reverting to the old title.

It was too late to turn this matter over to the Committee on Crude and Milled Drugs where it really belongs, and the question whether or not a change of the title Cascara Sagrada is approved was submitted to the vote of our committee. Out of eight answers received every one declared in favor of leaving the title Cascara as it stands, *viz.,* Cascara Sagrada.

IV. Solubilities of Acetphenetidin and Vanillin.

The U. S. P. IX states that one gram of Acetphenetidin dissolves in 90 mils of ether at 25 degrees C. Indications were that the solubility was lower. In reference to Vanillin, U. S. P. IX states that it is freely soluble in glycerin. This statement is somewhat misleading and has probably caused many disappointments to people who tried to prepare a concentrated flavor by dissolving vanillin in glycerin.

The determination of the solubility of Acetphenetidin in absolute and in U. S. P. IX ether and the solubility of vanillin in glycerin at 25 degrees C. was, therefore, to be carried out according to U. S. P. method for solubility determination by several members of the committee.

Only two reports have been received and the results are shown in table No. 3. The solubility of Acetphenetidin in U. S. P. IX ether

is at least twice as high as in absolute ether due, no doubt, to the small amounts of alcohol which are present in U. S. P. ether. For the same reason, probably the reported results on U. S. P. IX ether are not in good accord, 102 and 156, respectively. Apparently the ether used in one laboratory contained slightly more alcohol, and, therefore, gave a greater solubility. It would appear advisable to call these results to the attention of the U. S. P. Revision Committee, with the recommendation of either subjecting the figure on ether solubility of Acetphenetidin to a revision, or to omit reference to ether solubility altogether.

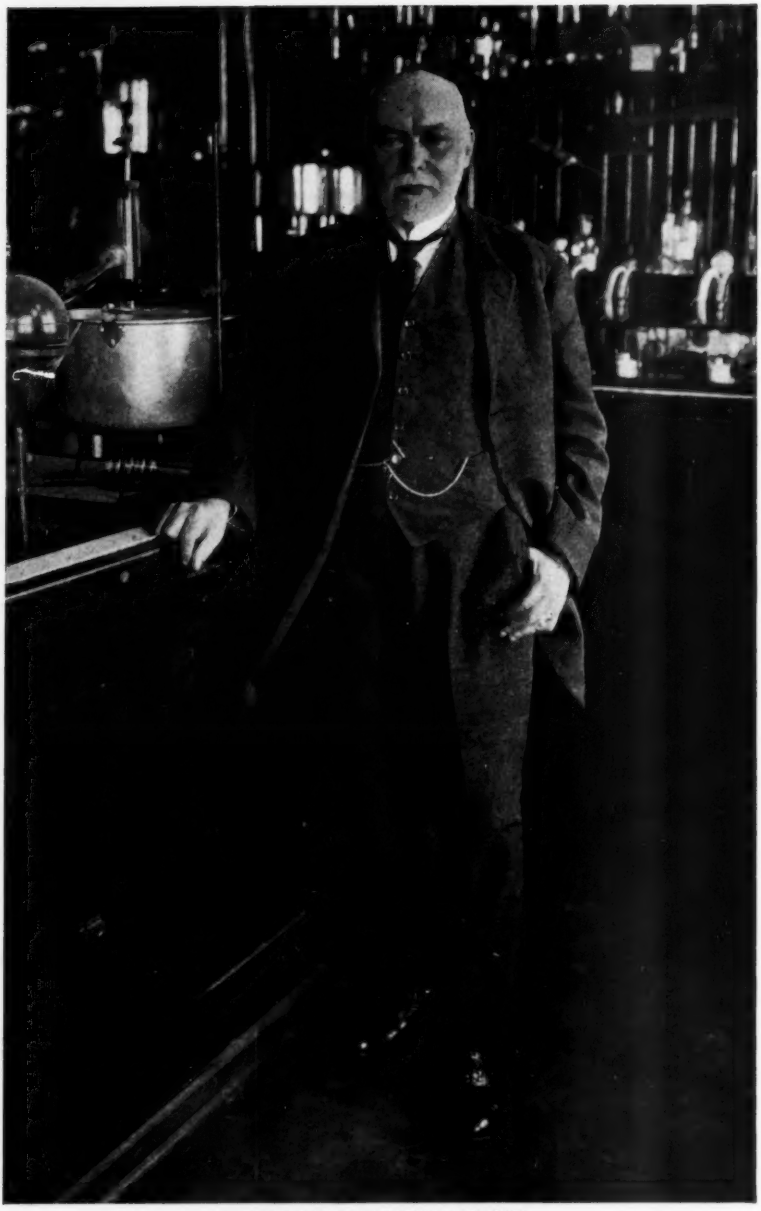
TABLE III.

SOLUBILITY OF ACETPHENETIDIN IN ETHER—SOLUBILITY OF VANILLIN IN GLYCERIN.

One Gram Acetphenetidin in cc.			Gm. Vanillin	
Absolute Ether	U. S. P. IX Ether	U. S. P. VIII Ether	in 100 cc. Glycerin	Reported by
325	102	—	5.1	F. O. Taylor
306	156	160	3.9	J. Bebie
	Ave. of 4 determinations	Alc. "not more than 3%"		
	Alc. in ether 3.6%			
315	129		4.5	Average

The solubility of vanillin in glycerin was determined by saturating glycerin in presence of excess of vanillin at 25 degrees by agitation, withdrawing a portion of the clear solution by means of a pipette protected at the tip by means of a wad of cotton, and extracting the vanillin with ether. In a blank test, the solubility of glycerin in this particular ether was determined and the amount found deducted from the amount of vanillin.

The average result of the solubility of vanillin in glycerin is 4.5 gm. of vanillin in 100 cc. of U. S. P. glycerin, and it would appear that a product should have a greater solubility than that to justify the designation of being "freely soluble." The U. S. P. in this case should give a specific solubility or should state that vanillin is slightly soluble in glycerin. It is known that at higher temperatures vanillin is very apt to form supersaturated solutions which are very slow in reaching an equilibrium on cooling and this condition is probably responsible for some of the erroneous conceptions regarding the solubility of vanillin in glycerin.



FREDERICK BELDING POWER.

A HALF CENTURY OF RESEARCH IN PLANT CHEMISTRY.

A Chronological Record of the Scientific Contributions of Frederick Belding Power.

Fifty years ago (1874), Editor Maisch accepted a paper for publication in the AMERICAN JOURNAL OF PHARMACY from a young man then recently graduated with honors from the Philadelphia College of Pharmacy. The article was an abstract of the young scientist's inaugural essay. It was the record of a painstaking investigation into the chemical nature of resin of podophyllum. And an inaugural essay it was in more than one respect, for it was the initial scientific contribution of a man whose efforts over the half century following his first offering have made his name and his work famous in the annals of chemical literature the world over. It was the beginning of a half century of research in plant chemistry—a half century of honest, earnest labor in the spacious vineyards of the finer sciences—a half century filled with useful effort consistent in its plan, and certain of its end results.

"Consistent in its plan." Not indeed an idle phrase conjured without a reason, but truly descriptive of this man's scheme of service. To the scurrying reader who tarries not, the following quotations may mean very little—but to him who reads the leads between the type there is here a great significance.

Thus:

EXHIBIT A

"Resina Podophylli"
By Frederick B. Power, G. P.
From an Inaugural Essay
(A. J. P., May, 1874)

EXHIBIT B

"It is to be regretted that Mr. Power's time did not permit him to pursue this subject further."
John M. Maisch
(A. J. P., May, 1874)

EXHIBIT C

"Resin of Podophyllum"
By Frederick B. Power, G. P.
(A. J. P., 1878)

EXHIBIT D

"Investigation of the Resin of Podophyllum"
(Ebert Prize Essay)
By Frederick B. Power
(Proc. A. P. A., 1877)

Consistent in its plan—complete in consummation—such indeed is the story of Frederick Belding Power's every effort during his half century of service in the field of phytochemistry. "He possesses that peculiar faculty of exhausting each subject which he takes up." Professor Maisch lived to realize that Mr. Power would not permit Time to dissuade him from pursuing his subject further!

Frederick Belding Power* was born in Hudson, N. Y., in 1853. His early education was gained at a private school and at the Hudson Academy. He graduated from the Philadelphia College of Pharmacy in 1874, the subject of his thesis being "Resina Podophylli."

After graduation, he decided to continue his scientific studies, and entered the University of Strassburg in 1876, from which in 1880 he received the degree of doctor of philosophy. During this period he conducted some important researches, and was appointed assistant to the eminent scientist Flückiger, who was one of his teachers.

He returned to America in 1880 and for three years was in charge of the chemical laboratory of the Philadelphia College of Pharmacy. He was the first to hold the chair of Analytical Chemistry at that institution. In 1883 he was called to the University of Wisconsin to organize the department of pharmacy, of which he was the dean, and there gave instruction in pharmaceutical chemistry and materia medica while also conducting laboratory work. In recognition of this service, and to commemorate the twenty-fifth anniversary of the establishment of the school of pharmacy, the University conferred upon him in 1908 the honorary degree of doctor of laws.

While still connected with the University of Wisconsin he was appointed a member of the Committee of Revision of the United States Pharmacopœia of 1890, and he has since that time con-

*The biographical sketch is reprinted from *The First Century of the Philadelphia College of Pharmacy.*

tributed largely to that work. Later (in 1920) he was elected first vice-president of the Pharmacopœial Convention. In 1892 he resigned his academic position in order to become the scientific director of the newly-established laboratories of Fritzsche Brothers, near New York, which were devoted to the production of essential oils and fine organic chemicals. It was while thus engaged that many of his well-known researches on the more important essential oils were conducted.

In 1896, when his life-long friend, Henry S. Wellcome, established his chemical research laboratories in London, Power was appointed director of that institution which has since gained such renown in the scientific world. He was thus in a position to devote himself exclusively to chemical research in which he was assisted by a large staff of highly-trained chemists. During those years in London Power gained a wide reputation for the highly scientific character and fruitfulness of his researches, which covered a wide field, especially in plant chemistry. The results of these researches were communicated to the various learned societies and published in the leading scientific journals. At the same time an opportunity was afforded him of meeting many of the most prominent scientists of Europe, with some of whom close and enduring friendships were formed.

He was elected a fellow of the London Chemical Society in 1896, and was also intimately associated with the Society of Chemical Industry, on the Council and Publication Committee of which he served for several years. In 1902, together with the late Dr. H. C. Wood, he was appointed by the Secretary of State as a delegate to the International Conference for the Unification of the Formulæ of Potent Medicaments which was held at Brussels. In 1913 the Chemical and Linnaean Societies and Pharmaceutical Society of Great Britain jointly awarded him the Hanbury Gold Medal in recognition of his researches in the natural history and chemistry of drugs. This was followed by the presentation to him of a beautiful illuminated address and album which represented the appreciation of numerous scientific men in many parts of the world and contained their signatures. In 1913 he received, also, the degree of master in pharmacy *honoris causa* from the Philadelphia College of Pharmacy. On resigning his position in London in 1914, in order to return to America, a gold medal bearing his profile in relief was awarded him by Henry S. Wellcome. This medal was in-

scribed as a recognition of his distinguished services to science during the eighteen and a half years as director of the Wellcome Research Laboratories in London. The presentation of this medal took place in Washington, D. C., in May, 1921, in the presence of Mr. Wellcome and a very distinguished company. The address on this occasion was delivered by Dr. Charles D. Walcott, Secretary of the Smithsonian Institution and President of the National Academy of Sciences, who in the course of his remarks said: "Dr. Power for fifty years has spent his thinking hours among the complicated molecules of organic compounds, and, because he possessed that peculiar faculty of exhausting each subject which he takes up, has had the greatest influence both in America and Great Britain in raising the standards of our Pharmacopœias. He has gained distinction by his most difficult and life-consuming researches into the chemical composition of plant compounds."

In 1916 he was assigned a position in the Bureau of Chemistry of the U. S. Department of Agriculture, where he is in charge of the Phytochemical Laboratory, and he was appointed by President Harding a member of the National Research Council. A recent honor conferred upon Dr. Power was his election to membership in the National Academy of Sciences.

Power has won great fame for his scientific research and his achievements are of so high a character that they are destined to assume even greater importance in the years to come. The extent of his work and his incalculable services to his profession may be judged by surveying this brilliant record of his scientific contributions. It will not be amiss to note in passing that the investigations recorded herewith are peculiarly linked to certain phases of his scientific career.

Thus investigations Nos. 3-9, inclusive, were conducted while he was a student at the University of Strassburg.

The literary work represented by No. 10 was accomplished while Professor of Analytical Chemistry in the Philadelphia College of Pharmacy.

The investigations and literary work recorded in Nos. 11-33, inclusive, were conducted while occupying the position of Professor of Pharmaceutical Chemistry and Materia Medica in the University of Wisconsin. During that period a great deal of time was devoted to the seventh decennial revision of the U. S. Pharmacopœia (1890).

The researches Nos. 34-41, inclusive, which pertain chiefly to essential oils, were conducted while Scientific Director of the manufacturing laboratories of Fritzsche Brothers.

The large number of investigations represented by Nos. 42-116, inclusive, which cover a wide range of subjects, were accomplished while Director of the Wellcome Chemical Research Laboratories, London.

The numbers 117-127, inclusive, pertain to researches or scientific contributions to the present date and these have been conducted while in charge of the Phytochemical Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture.

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27. On the Chemical Constituents and Poisonous Principle of the Bark of *Robinia Pseudacacia*, Linné. *Pharm. Rundschau*, 1890, *8*, 29-38. (Co-author.)
28. Chemical Examination of Some Loco Weeds. *Pharm. Rundschau*, 1891, *9*, 8-12. (Co-author.)
29. Review of Some Cases of Poisoning by the So-called Wild Parsnip. *Pharm. Rundschau*, 1891, *9*, 162-165.
30. On the Characters of the Scale Salts and Other Official Compounds of Iron and Some Proposed Standards for Their Volumetric Estimation. *Pharm. Rundschau*, 1891, *9*, 205-217.
31. On a Third Alkaloid of Hydrastis Root. *Pharm. Rundschau*, 1891, *9*, 262-263.
32. Notes on *Oleum Aethereum* (Heavy Oil of Wine). *Pharm. Rundschau*, 1891, *9*, 263-268.
33. A Review of Some Assumed Tests for the Discrimination of Natural and Synthetic Oils of Wintergreen and a Reliable Test of Purity for These Oils. *Pharm. Rundschau*, 1892, *10*, 7-9.
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39. On the Constituents of Oil of Bay. *Pharm. Rundschau*, 1895, *13*, 60-63. (Co-author.)
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42. Note on Extemporaneous Chlorine Water. *Pharm. Review,* 1897, *15,* 108.
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107. Chemical Examination of the Roots of *Phaseolus multiflorus*. *Pharm. Journ.*, London, 1913, *90*, 550-552. (Co-author.)
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115. The Constituents of the Flowers of *Matricaria Chamomilla*. *Journ. Chem. Soc.*, 1914, *105*, 2280-2291. (Co-author.)
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118. The Distribution and Characters of Some of the Odorous Principles of Plants. *J. Ind. Eng. Chem.*, 1919, *11*, 344-352. Presidential address delivered before the Chemical Society of Washington.
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124. The Occurrence of Methyl Anthranilate in Grape Juice. *J. Amer. Chem. Soc.*, 1921, *43*, 1741. (Co-author.)
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The preceding list of publications does not include a considerable number of book reviews, biographical sketches, addresses, etc.

Awards.

1874. Prize in Chemistry from the Philadelphia College of Pharmacy.
1877. Ebert Prize of the American Pharmaceutical Association.
1903. Ebert Prize of the American Pharmaceutical Association.
1904. Gold Medal, St. Louis International Exhibition.
1905. Silver Medal, Liége Exhibition.
1906. Gold Medal and Diploma of Honor, Milan Exhibition.
1907. Ebert Prize of the American Pharmaceutical Association.
1908. Gold Medal, Franco-British Exhibition, London.
1910. Grand Prize, Brussels Exhibition.
1911. Gold Medal and Diploma of Honor, Turin Exhibition.
1913. Hanbury Gold Medal, London.
1921. Gold Medal, presented by Henry S. Wellcome, "in recognition of distinguished services to science during eighteen and one-half years as Director of the Wellcome Chemical Research Laboratories, London."
1922. Flückiger Gold Medal, by the Swiss Pharmaceutical Society.

Thus endeth the chronicle of a man's achievements over a half century of active, useful service. And the man still carries on into the second half century, serving with equal alertness and mental vigor. Today in scientific Washington no one is more highly re-

garded than Frederick Belding Power and his laboratory is the shrine of many who come to seek inspiration in the atmosphere of his work-place and in his kindly personality. Said Pasteur: "Take interest, I implore you, in those sacred dwellings which one designates by the expressive term: LABORATORIES. Demand that they be multiplied, that they be adorned; these are the temples of the future—temples of well-being and of happiness. There it is that humanity grows greater, stronger, better."

Truly the laboratory of Frederick Belding Power has fulfilled in every sense Pasteur's immortal sentiment.

IVOR GRIFFITH.

THE ONE HUNDRED AND FIRST ANNUAL COMMENCEMENT OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE.

The one hundred and first annual commencement of the Philadelphia College of Pharmacy and Science was held Wednesday morning, June 4, in the American Academy of Music, Broad and Locust Streets, friends and relatives of the nearly three hundred graduates filling the immense auditorium.

President W. C. Braisted conferred the degrees upon 267 candidates presented by the Deans. Former Governor William C. Sproul gave a most impressive address, in which he dealt with those fundamental and vital matters that determine human success.

The degree of Master in Pharmacy, Honoris Causa, was conferred upon John Culley, '94, of Ogden, Utah, for many years a prominent worker in the National Association of Boards of Pharmacy; upon Louis Emanuel, '76, for thirty years a member of the Pennsylvania Board of Pharmacy, and one of the organizers of the Pittsburgh College of Pharmacy; upon Joseph Jacobs, '79, a successful druggist of Atlanta, Georgia, who has also rendered conspicuous service along scientific and literary lines; upon Frank E. Morgan, Phar. D., Medico-Chi, an outstanding scientific pharmacist of Philadelphia; and upon Professor Wilbur L. Scoville, formerly professor in the Massachusetts College of Pharmacy, now a research worker connected with Parke, Davis & Co., and a member of the Revision Com-

mittee of the U. S. P. and N. F. Other degrees were conferred as follows:

Bachelor of Science in Pharmacy (B. Sc.)

Sung, Le Kya, B. A., M. D. ..... China

Bachelor of Science in Pharmacy and Chemistry (B. Sc.)

Beauchamp, Eurico Ramon ..... Porto Rico
DeHoff, Hugh Clifton ..... Pennsylvania

Bachelor of Science in Chemistry

Ambrose, M. Antony Michael ..... Pennsylvania
Wood, Henrietta Cooper ..... New Jersey

Bachelor in Pharmacy (Phar. B.)

Clar, Allen Benson, Jr. ..... Missouri
Hood, Thomas Ruffin ..... North Carolina
Long, William James ..... Pennsylvania
McCreary, William Randolph ..... Pennsylvania
Ortiz-Botello, Ilia Maria ..... Porto Rico
Steinberg, Israel ..... New Jersey
Walker, James Carter, Jr. ..... Texas

Pharmaceutical Chemist (Ph. C.)

Goldburg, Joseph Raymond ..... Pennsylvania
Kohen, Morris ..... New Jersey

Graduate in Pharmacy (Ph. G.)

Abrams, Morris ..... Pennsylvania
Abramson, Maurice ..... Pennsylvania
Agre, Louis ..... Pennsylvania
Albanese, Patrick Jack... Pennsylvania
Aldinger, Walter K. F... Pennsylvania
Amico, Mary Catherine.. Pennsylvania
Atchick, Aaron Louis ... Pennsylvania
Augenblick, Ben Dessen.. Pennsylvania
Ball, William Allen ..... Illinois
Barmach, Jack Ernest ... Pennsylvania
Barth, August Edward... Illinois
Bass, Jacob ..... Pennsylvania
Beard, Rae Ruth..... New Jersey
Beck, Max Joseph ..... Pennsylvania
Belov, Nathan ..... Pennsylvania
Berger, Joseph Elliot ... Pennsylvania
Berger, Melvin Lewis .... Pennsylvania
Berman, Samuel ..... Pennsylvania
Black, Gertrude Anna .. Pennsylvania
Blecharsky, Philip ..... Pennsylvania
Bloom, Ellis Jacob ..... Pennsylvania
Bond, Herbert William... Pennsylvania
Bonn, Benjamin Leon ... Pennsylvania
Bonow, Samuel ..... Pennsylvania
Braverman, Jack B. ..... Pennsylvania
Bressler, Douglas ..... Pennsylvania
Brink, Joseph William .. Pennsylvania
Brouse, George Ernest... Pennsylvania
Brown, Henry John ..... Pennsylvania
Brown, Henry Ulrich.... Pennsylvania
Brown, Robert Fred..... Pennsylvania
Buchanan, James W..... Pennsylvania
Burch, Morris Davis.... New Jersey
Butz, Albert Page..... New Jersey

Buzby, Arthur Louis....Pennsylvania
Castor, Frank Stevens ...North Carolina
Catrino, Joseph Anthony..Pennsylvania
Cauffman, Edwin Carter..Pennsylvania
Clair, Everett Nelson....New York
Clark, Frederick Stanley..Pennsylvania
Clarke, Paul Bertram....Pennsylvania
Cohn, Samuel .....Pennsylvania
Conover, Joseph Robbins.New Jersey
Cormeny, George F. ....Pennsylvania
Courtney, Arthur O. ....Pennsylvania
Covell, Arthur Maynard.Florida
Cowdrick, Sherman T. ..Pennsylvania
Cunningham, John Carl..Pennsylvania
DeBartolomeis, Julius P...Delaware
Dick, Gerald Gordon ....Pennsylvania
Dingler, Henry Lewis....Pennsylvania
Dogolevsky, Louis .....Pennsylvania
Dolbey, Wilmer Biles....Pennsylvania
Dressler, Harry Bernard.Pennsylvania
Dubinsky, Louis Mark...Pennsylvania
Dzwonchyk, John Harry..Connecticut
Eitel, Charles August....Pennsylvania
Ellick, Harry Jacob.....Pennsylvania
Englund, Walter Richard.Connecticut
Epstein, Joseph Arthur..Pennsylvania
Etsenson, Lewis .....Pennsylvania
Evans, Herman .....Pennsylvania
Feldman, Israel .....Pennsylvania
Ferko, Stephen Andrew..Pennsylvania
Fickel, Morrell MacK....Pennsylvania
Finkelstein, Louis J. ....Pennsylvania
Fisher, Ralph .....Pennsylvania
Fogg, Frank Emil.....New Jersey
Forman, Philip .....Pennsylvania
Fox, Joseph Daniel.....Pennsylvania
Francisco, Frank Joseph..Pennsylvania
Frankfurt, John Eugene..Delaware
Fried, Rubin .....Pennsylvania
Friedman, Morris Boris..Pennsylvania
Friedman, Ned .....Pennsylvania
Frontz, Maurice Clinton..Pennsylvania
Geary, John Wesley.....Pennsylvania
Gershenfeld, David B.....Pennsylvania
Gilpin, Burton Harvey...Pennsylvania
Glauser, Pearl .....Pennsylvania
Gluskin, Benjamin David.Michigan
Golden, Thomas Joseph..Pennsylvania
Good, Robert DeWalt...Pennsylvania
Goodrich, Ralph Archer..Pennsylvania
Goodyear, Marcus A.....Pennsylvania
Gundrum, Donald W.....Pennsylvania
Haas, Julius .....Austria
Halligan, Francis Xavier.Pennsylvania
Hanlon, James Francis...Pennsylvania
Harbison, George Calvin.Pennsylvania
Hartman, Henry Albert..Pennsylvania
Heard, William Pierce...Arkansas
Hendricks, Walter J.....Pennsylvania
Herbst, Marion Leanna..Pennsylvania
Hirsh, John Jay.....Pennsylvania
Holland, Archibald .....Delaware
Hornik, Guerch .....Pennsylvania
Horton, Joseph Maynard.Pennsylvania
Houtz, Lloyd Edward...Pennsylvania
Jacobs, Arthur Leon.....Pennsylvania
Jones, Evan Thomas.....Pennsylvania
Joseph, Nathan .....New Jersey
Kane, Samuel .....Pennsylvania
Katzman, Julius Richard.Pennsylvania
Kaufmann, Theodore R...Pennsylvania
Kerlin, Samuel Harold...Pennsylvania
Kimmelman, Harry .....Pennsylvania
Kingstone, David A.....Pennsylvania
Klebanoff, David .....Pennsylvania
Kohan, Bartholomew J....New Jersey
Kohler, Stewart McK....Pennsylvania
Kuner, Harry .....Pennsylvania
Laird, Wilbur Russel....Pennsylvania
Laskowski, Bernard T....Pennsylvania
Laws, Oregon Columbus..Virginia
Lehman, Frederick E.....Pennsylvania
Lepper, Norman .....Pennsylvania
Levin, Eugene Yale.....New Jersey
Levin, Isadore .....Pennsylvania
Lewis, James Clarence...Pennsylvania
Lewis, Robert Morris....Pennsylvania
Lieb, Theodore Louis....Pennsylvania
Lieberman, Nathan H.....Pennsylvania
Light, David .....Pennsylvania
Linfante, Silvio .....Pennsylvania
Ludlow, Edith .....New Jersey
Lyckberg, Theodore D....Illinois
McConnell, Clarence W...Pennsylvania
McCoy, Agnes Elsie.....Pennsylvania
McGuire, Redmond J.....Pennsylvania

McLaughlin, Guy W.....Pennsylvania
McMurray, Ellis Edwin..Pennsylvania
McTague, Daniel F.....Pennsylvania
Mack, Edward James....Pennsylvania
Mackie, Earl Robert.....Massachusetts
Madeira, Robert Spencer.Pennsylvania
Malpass, George Nock...Pennsylvania
Marcus, Morris .....Pennsylvania
Martin, Emlen Linton....Pennsylvania
Martin, Frank Gorman..Pennsylvania
Maskornick, Peter .....Pennsylvania
Mease, Earl Herman....Pennsylvania
Menderson, William T...Pennsylvania
Merrick, James B.....Pennsylvania
Messey, Joseph William..Pennsylvania
Moorer, Alfred Edward..South Carolina
Morrin, George Frank...Pennsylvania
Morris, Arthur Edward..Colorado
Moser, Roland Lambert..Pennsylvania
Moyer, Helen Foerstner..Pennsylvania
Muldoon, Eugene Joseph.Pennsylvania
Mullen, Edward Joseph..Pennsylvania
Mullen, Ira Alonza.....Pennsylvania
Mundy, Mary Rosamund.Pennsylvania
Murphy, Edward J.....Pennsylvania
Myers, Adeline .....Pennsylvania
Myers, Morris .....New Jersey
Nagy, James Tihamer...Pennsylvania
Nichols, Enos Mead.....Pennsylvania
Nichols, Sidney .....Pennsylvania
Nissley, Paul Herr .....Pennsylvania
Nitzberg, Albert Phillip..Pennsylvania
Nolan, Raymond A.....Pennsylvania
Nowak, Abraham H.....Pennsylvania
O'Hare, James Condra...Pennsylvania
O'Loughlin, James H.....West Virginia
Parlin, Milton .....New Jersey
Parris, Clara .....Pennsylvania
Pasquariello, Patrick S...Pennsylvania
Polhemus, Hanford E....New York
Possoff, Theodore .....Pennsylvania
Rabin, Nathan Eisman...New Jersey
Rackie, Theresa M.....Pennsylvania
Rappaport, Lillian .....Pennsylvania
Rees, Thomas Etner.....Pennsylvania
Rice, Thomas Leslie.....Pennsylvania
Riegel, Harold William..Pennsylvania
Riley, William Merle....Pennsylvania
Ringer, Theodore Haydn.Pennsyvania
Roney, John Joseph, Jr...Pennsylvania
Rosner, Henry .....Alabama
Rosvold, Sigurd David..Minnesota
Rothman, Marcus Lewis..Pennsylvania
Rozanski, Frank Joseph..New Jersey
Rozboril, John Joseph....New York
Rubinstein, Samuel .....Pennsylvania
Runyan, Franklin Smith.Pennsylvania
Sacco, William Emerson.New Jersey
Sailer, Harold .....Pennsylvania
Sandler, Jacob .....New Jersey
Saprinsky, Max .....Pennsylvania
Schacht, Robert W.....Pennsylvania
Schrope, Eldon Zerbe....Pennsylvania
Scott, Thornton F. B., Jr..Pennsylvania
Search, John Edgar.....Pennsylvania
Segal, Herman Charles..New Jersey
Seidel, Lee Hartman....Pennsylvania
Shafer, Albert J. F.....Pennsylvania
Shary, Clarence Damon..Nebraska
Shea, John Paul.....Pennsylvania
Sheedoch, John R.....Pennsylvania
Shimer, Albert G.....Pennsylvania
Shpatzenkopf, Sigmund..Pennsylvania
Silnutzer, Meyer .....Pennsylvania
Singer, Simon .....Pennsylvania
Sivaton, Abraham B.....Pennsylvania
Slutsky, Lewis Charles...Pennsylvania
Smoot, Aubrey Cannon..Virginia
Soto, Perla Morejon....Cuba
Stein, Roy Harold.....Pennsylvania
Steinberg, Charles .....Pennsylvania
Steinberg, David W.....Pennsylvania
Steinhaus, Nathan .....Pennsylvania
Stem, George Sherman..Pennsylvania
Stoneback, Harvey W....Pennsylvania
Swabon, Isabel Justine...Pennsylvania
Swartz, Morris Harry...Pennsylvania
Titman, Harry Charles..New Jersey
Tomlin, Pierce J., Jr.....Pennsylvania
Trethewey, Byron H.....Pennsylvania
Trinsey, John Sigmund..Pennsylvania
Troxell, Charles Simon..Pennsylvania
Tye, Francis Joseph.....Pennsylvania
Unangst, John Joseph....Pennsylvania
Urch, Kathryn Parmley..Pennsylvania
Vilensky, Benjamin .....New Jersey

Walker, Augustus W.....Pennsylvania
Walsh, William H. McD..Pennsylvania
Ward, Alfred .....Pennsylvania
Ward, Harry Beecher....Pennsylvania
Wasserman, Fannie .....Pennsylvania
Weaver, John Henry.....Pennsylvania
Weeks, Eunice Dorothy..New Jersey
Weinberg, Harry B.....Pennsylvania
Weiner, Lester Bernard..Pennsylvania
Weisberg, Abraham ....Pennsylvania
Welsh, James Joseph ...Pennsylvania
Werner, David Isadore..Pennsylvania
Willard, Samuel Russell.Pennsylvania
Williams, Russell R.....Pennsylvania
Willig, Clarence Henry...New Jersey
Wilson, Edward M.....Pennsylvania
Wolf, Lawrence Albert...Pennsylvania
Wood, Theodore Harrar.Pennsylvania
Woodward, Reginald E..Pennsylvania
Wylie, Robert Donald....Pennsylvania
Young, William Arthur..Pennsylvania
Ziegler, James Martin...Pennsylvania

CERTIFICATE IN TECHNICAL CHEMISTRY

(Three-Year Course)

Brockmyre, Henry F.....New York
Leavesley, George W.....Pennsylvania
McGowan, Frank .....Pennsylvania
Russell, Maurice .....New Jersey
Webster, Walter O., Jr...New Jersey

STUDENTS WHO HAVE COMPLETED SPECIAL COURSES AND QUALIFIED FOR CERTIFICATES

In Bacteriology

Clement, Joseph Leon....Pennsylvania
Holliday, Jessie G.....North Carolina
Hurst, Charles F. .....Texas
Lichtin, Aaron .....Russia
Mantai, Melanie Arsena..Pennsylvania
McCullough, T. Herman.Pennsylvania
McMurray, Ellis Edwin..Pennsylvania
Petrov, Morris .....Pennsylvania
Racier, Robert S.....Pennsylvania
Slobig, Katherine M.....Maryland
Spangler, Joseph W.....Pennsylvania

In Clinical Chemistry

Beauchamp, Eurico R.....Porto Rico
Evans, Herman .....Pennsylvania
Gluskin, Benjamin David.Michigan
Lichtin, Aaron .....Russia
McCullough, T. Herman.Pennsylvania
Orloff, Benjamin .....Pennsylvania
Quezada, V., J. B. A.....Panama
Racier, Robert S.....Russia

In Physiological Assaying

Bloom, Ellis Jacob.....Pennsylvania
Bass, Jacob .....Pennsylvania
Seeman, Michael John....Austria
Lieberman, Nathan H.....Pennsylvania
Feldman, Israel .....Pennsylvania
Agre, Louis .....Pennsylvania
Biscontine, Hercules J....Pennsylvania

In Perfumery and Cosmetics

Beard, Rae Ruth.....New Jersey
Lachman, Abraham .....Pennsylvania

In Advanced Pharmacognosy

Wassermann, Leon .....Pennsylvania

In Advanced Business Administration

Ludlow, Edith .....New Jersey

AWARD OF PRIZES

1924

Presentation of the Howard B. French Cup to the Graduating Class of 1924
Presentation of the Martin Cup to the Graduating Class of 1924

Graduate in Pharmacy (Ph. G.) Course

DISTINGUISHED

Guerch Hornik
David Klebanoff
Isadore Levin
Adeline Myers
Sidney Nichols
Pierce Joseph Tomlin, Jr.

MERITORIOUS

Maurice Abramson
Louis Agre
Jacob Bass
Nathan Belov
Joseph Elliot Berger
Samuel Berman
Douglas Bressler
George Ernest Brouse
Everett Nelson Clair
Arthur, Orville Courtney
Herman Evans
Walter Jacob Hendricks
Stewart McKaine Kohler
Norman Lepper
Nathan Harold Lieberman
Morris Marcus
Albert Phillip Nitzberg
Abraham Hymen Nowak
Clara Parris
Patrick Samuel Pasquariello
Theodore Possoff
Theresa Magdalen Rackie
Sigurd David Rosvold
Herman Charles Segal
Lee Hartman Seidel
Clarence Damon Shary
George Sherman Stem
David Isadore Werner

The **Procter Prize,** a gold medal and certificate for the highest general average of the class, is awarded to

ADELINE MYERS

The **William B. Webb Memorial Prize,** a gold medal and certificate for the highest general average in the branches of Operative Pharmacy, Analytical Chemistry and Pharmacognosy, is awarded to

ADELINE MYERS

With Honorable Mention to

Sherman Tracey Cowdrick	Albert Phillip Nitzberg
Arthur Leon Jacobs	Theodore Haydn Ringer
Frederick Emerson Lehman	John Sigmund Trinsey
George Nock Malpass	Abraham Weisberg

James Martin Ziegler

The **Remington Memorial Prize,** $20.00, offered by the Estate of Joseph P. Remington, for the highest general average in the examinations in Operative Pharmacy and Dispensing, is awarded to

GUERCH HORNIK

With Honorable Mention to

Adeline Myers	Harold William Riegel
Clara Parris	George Sherman Stem

Pierce Joseph Tomlin, Jr.

The **Frank Gibbs Ryan Prize,** a gold medal endowed by the Class of 1884, as a memorial to their distinguished classmate, for the best average in the Chemical and Pharmaceutiacl Laboratory courses, is awarded to

GUERCH HORNIK

With Honorable Mention to

Jacob Bass	Adeline Myers
Harry Jacob Ellick	Sydney Nichols
David Klebanoff	Albert Philip Nitzberg
Roland Lambert Moser	Clarence Damon Shary

Pierce Joseph Tomlin, Jr.

The **Mahlon N. Kline Pharmacy Prize,** a Troemner Prescription Balance, offered by the Mahlon N. Kline Estate, for the highest average in Theory and Practice of Pharmacy, is awarded to

PIERCE JOSEPH TOMLIN, JR.

With Honorable Mention to

Maurice Abramson	Guerch Hornik
Nathan Belov	David Klebanoff
Samuel Berman	Isadore Levin
Joseph Daniel Fox	Adeline Myers

The **Bacteriology Prize,** $25.00, offered by the H. K. Mulford Company for the highest general average in Bacteriology and Serum Therapy, is awarded to

ADELINE MYERS

With Honorable Mention to

Maurice Abramson — William Randolph McCreary
David Klebanoff — Sidney Nichols
Isadore Steinberg

The **Business Administration Prize,** $20.00, offered by Professors E. Fullerton Cook, Howard Kirk and Spencer Brown Roland for the highest general average in Business Administration, is awarded to

JOSEPH ELLIOT BERGER

With Honorable Mention to

Bernard Theodore Laskowski — Guy William McLaughlin
Isadore Levin — Edward Mack
David Isadore Werner

The **Pharmacy Review Prize,** one year's membership in the American Pharmaceutical Association, offered by Professor Ivor Griffith, P. D., for the highest general average in Theory and Practice of Pharmacy in the Senior Year, is awarded to

GUERCH HORNIK

With Honorable Mention to

Joseph Daniel Fox — Adeline Myers
Morris Marcus — Pierce Joseph Tomlin, Jr.

The **Maisch Botany Prize,** $20.00 in gold, offered by Joseph Jacobs, Ph. G., Phar. D., D. Sc., of Atlanta, Ga., for the best herbarium collection of plants, is awarded to

EDWIN CARTER CAUFFMAN

With Honorable Mention to

Abraham H. Nowak

PRIZES FOR POST-GRADUATE COURSES

The **Advanced Pharmacy Prize,** ten dollars' worth of books, offered by Professor Charles H. LaWall for the highest grade in Advanced Pharmacy, in either the Ph. G. or the Phar. B. Course, is awarded to

ISRAEL STEINBERG

With Honorable Mention to

Joseph Raymond Goldburg, Dr. Le Kya Sung

The **J. B. Moore Memorial Prize,** $25.00 in gold, offered by the Rev. J. J. Joyce Moore and Mrs. H. H. Watkins, Jr., in memory of their father, J. B. Moore, to the member of the graduating class presenting the best thesis representing work in the Department of Pharmacy, is awarded to

JOSEPH RAYMOND GOLDBURG

PRIZES AWARDED BY THE ALUMNI ASSOCIATION

The **Alumni Gold Medal,** for the highest general average in all branches in the Senior Year, is awarded to

ADELINE MYERS

The **Alumni Prize Certificate,** for the highest general average in individual branches in the Senior Year, are awarded as follows:

Pharmacy .....to.....Pierce Joseph Tomlin, Jr.
General Chemistry .....to.....Pierce Joseph Tomlin, Jr.
Materia Medica .....to.....Clara Parris
Operative Pharmacy .....to.....Adeline Myers
Analytical Chemistry .....to.....Harvey Walter Stoneback
Pharmacognosy .....to.....Pierce Joseph Tomlin, Jr.
Business Administration .....to.....Joseph Elliot Berger

PRIZE AWARDED TO UNDER-GRADUATE STUDENT

The **Alumni Silver Medal,** for the highest general average in all branches in the Junior Year, is awarded to

MISS SADIE BRISGOL

The **Upsilon Sigma Phi Fraternity Prize,** $25.00, for the member of the first year class who attained the highest general average, is awarded to

SADIE BRISGOL

Countries and States Represented

Pennsylvania, New Jersey, New York, Delaware, Maryland, Virginia, North Carolina, South Carolina, Florida, West Virginia, Alabama, Arkansas, Missouri, Texas, Colorado, Massachusetts, Connecticut, Michigan, Illinois, Minnesota, Nebraska; and Cuba, Porto Rico, Panama, Russia, Austria and China.

SCIENTIFIC AND TECHNICAL ABSTRACTS

ANALYSIS OF LYSOL. A. H. DODD. (*J. Soc. Chem. Ind.*, 1924, *43*, 93-96 T.) Through the *Analyst.*—The author has examined the various methods adopted to effect the separation and measurement of the tar acids, including the separation of phenols by steam distillation, as recommended by the German Pharmacopœia and the method of Jordan and Southerden (*Pharm. J.*, 1921, *47*a), and Chapin's method of extracting the tar acids with benzene, forming the phenates by adding 1 :2 sodium hydroxide solution to the benzol

solution, evaporating the bulk of the benzene and decomposing the phenates with acid. Although the distillation method of separating tar from fatty acids, etc., is not generally recommended, such divergent results were obtained by other methods that the author carried out lengthy trials, and after applying corrections obtained results accurate to within 0.5 per cent. One hundred grms. (if possible) of lysol are measured into a separator, shaken with sufficient 2 per cent. sulphuric acid to destroy the emulsion and separate the fatty acids, 50 cc. of ether added, the supernatant layer separated and the dilute acids again washed with 20 cc. of ether. The ethereal solution of fatty acids and phenols is dried over fused sodium sulphate (otherwise a sharp separation on distillation will not be obtained), filtered into a 250 cc. distillation flask, and washed in with ether. The ether is distilled, and the fraction passing over between 100 degrees and 160 degrees C. tested for ether. The phenols are then slowly distilled at the rate of 1 to 2 drops per second, the flask and burner being completely enclosed in a metal cylinder, and the thermometer projecting from a sheet of asbestos used as a covering. The temperature gradually rises to a maximum at about 215 degrees C., the rate of distillation falls and the temperature drops, phenols distilling slowly all the time. The flame is then gently raised till the temperature exceeds the former maximum by about 5 degrees. After more drops have come over the temperature will again fall, and, on the third time of heating, 230 degrees C. can be reached, and impure cresylic acid comes over. After this, an increase in the size of the flame will send the temperature rapidly up to 300 degrees C. The necessary corrections were obtained by finding the percentage of cresylic acid distilling with mixtures of the usual quantities of oelic and cresylic acids (1) temperatures to 225 degrees C. and percentages obtained on first heating; (2) to 220 degrees C. after the temperature falls and the flame is raised; (3) on slowly distilling to 230 degrees C. The results are given in a table. A comparison of the ordinary direct distillation method, Jordan-Southerden's, and Chapin's methods was made on ten different brands of lysol, and the results (given in a table) show the need for an official method, since they differ from about 2 to 12 per cent. according to the method used.

Death From Carbon Monoxide in Automobile Exhaust. —Widespread attention is being called to the dangers of automobile

exhaust gases, and the following instance reported in the *Bulletin of the Royal Academy of Belgium* (issue of March, 1924), represents an unusual feature. Usually the fatal cases have occurred in closed garages, in which the engine has been running while some one was attending to the car. It has also been shown that even in the open street when this is crowded with motor vehicles a serious pollution of the lower stratum of the air may be produced. In the Belgian case, a night excursion by autobus was planned. It seems that a peculiar form of excursion has been developed in Belgium. A party of a dozen or so are taken in a closed bus at night in such a way that they do not know the direction and after some miles of journey they are released and expected to find their way home. Those who arrive first at the point of departure receive prizes. The conditions of the excursion are, of course, that the bus should be well closed, so that no one can glean any information as to the route taken. We learn from the report that the car had a Ford motor. About a score of the contestants were packed in the bus, and a conductor and two assistants were on the outside. The passengers began the journey joyously singing and talking, but this soon ceased, and later some of the party hammered on the sides of the car, complaining of the lack of fresh air and of the heat. The persons in charge of the excursion hesitated to open any part, suspecting that it was merely a trick to get some idea of the neighborhood through which the bus was passing. On arriving at the destination, the conveyance was opened, and twelve of the party were found unconscious. All were removed to fresh air; eleven recovered consciousness, but one, a lad of seventeen, died. Those who could be questioned concerning the symptoms stated that the unconsciousness developed suddenly. Post-mortem examination of the boy showed the characteristic conditions of carbon monoxide poisoning. H. L.

THE ARSENIC SUPPLY.—It may seem strange that there should be any anxiety as to the amount of arsenic available, but a pamphlet recently issued by Mr. Henry A. Armbruster points out that the question is one of great importance. The pamphlet consists of essays and reports of speeches. The consumption of arsenic in the manufacturing industries of the United States amounts to about 16,000 tons per year. The principal use is for insecticides for agriculturists, but some of it is used in glass. Some years ago an in-

dustrious and prolific mother crossed the Rio Grande del Norte, established herself in Texas, raised a large family which has since spread over a wide area of the "cotton belt" and produced some profound social and economic changes. Scientifically termed *"Anthonomus grandis,"* it is better known as the "boll weevil," and does great harm by attacking the cotton boll before it is ripe. So far it seems to specialize in this, but climatic influences and the loss of its proper food may develop strains that will attack other important plants. Already some of its progeny have shown an increased resistance to low temperature. Originally a subtropical species, it has pushed notably towards sections in which the temperature falls close to the freezing point, and some strains have been observed which bear the chilling fairly well. So far, calcium arsenate has been the only clearly successful poison against the insect. The bulk of the supply of arsenic has come from the smelting of ores of the precious metals. Formerly the fumes were allowed to escape, but litigation restricted this practice and the Cottrell process facilitated recovery, so that the supply has been fairly abundant. Nevertheless, the enormous amount of arsenic now required is such that care should be taken to maintain the industry in an active condition and tariff control may be necessary to aid. The insect may, as noted above, turn its attention to food plants and cause much damage. The whole question of combating insect and fungus pests is one of the greatest importace, and is a war in which there can be no armistice. H. L.

New Essential Oils.—The family Myrtaceae is abundantly developed in Australia, the genus *Eucalyptus* being a highly characteristic feature of the tree flora, but many other genera are well represented. Studies of the essential oils which are notable ingredients of the tissues of the members of this family are being made by chemists in Australia. Among the recent contributions in this line are reports by A. R. Penfold, F. C. S., Economic Chemist of the Sydney (N. S. W.) Technologic Museum. The reports appeared in the *Jour. Roy. Soc.*, N. S. W., (1923, *57*, 237; 1924, *57*, 300). Two plants of the Myrtaceae have been examined. *Backhousia angustifolia*, F. v. M., and *Darwinia grandiflora* (Benth.) B. & S. The former, a small tree, is found only in Queensland. The oil was distilled from 585 pounds of the dried leaves, yielding about 1 per cent. A sample of oil was also obtained from a tree under cul-

tivation in the Botanic Gardens of N. S. W. This sample was not entirely in accord in composition with that from the wild species. The principal constituent was found to be a phenol, hitherto undescribed, which is present to the extent of about 75 per cent. Other ingredients are of the type usually found in such oils. The dominating substance is of a peculiar nature, recalling somewhat tasmanol and leptospermol. The oil as distilled was of two gravities, about equal parts lighter and heavier than water, respectively, and gave the following constants:

	Light Oil	*Heavy Oil*
Specific Gravity 15°/15° C.	0.9795	1.0355
Optical rotation	—0.85	—1.6
Refractive index at 20° C.	1.4808	1.4991
Solubility in 70% alcohol	1 in 1.1 vols.	1 in 1.4 vols.
Phenolic content	44%	80%

The phenolic ingredient gave combustion data applying to the formula $C_{10}H_{14}O_3 = 182$. Molecular weight determination by Landsberger boiling point method gave 184, and by cryoscopic method, 186. It is soluble in all ordinary organic solvents, acid to litmus, and soluble in boiling sodium carbonate and sodium acid carbonate solutions, but not in the cold. It is precipitated from alkaline solutions by mineral acids and partly by a current of carbon dioxide. Several derivatives have been prepared but the substance is still under investigation. of which further report will be made later.

The oil of *Darwinia grandiflora* yielded a new acetic ester. The plant is a small tree growing in several parts of Australia. The percentage of oil is small, and samples from different localities differed somewhat. The most interesting feature was the discovery that while in earlier studies of the oil geranyl acetate had been suspected, Penfold found that although this may be present in minute amount, the bulk of the ester saponifiable by cold alcoholic potassium hydroxide in two hours yields an acetate and alcohol of highly dextrorotatory power, resembling verbenol and provisional termed "darwinol." It has been the custom to assume with oils from the Myrtaceae, an ester which can be saponified at room temperature in two hours by alcoholic potassium hydroxide is geranyl acetate, but in the light of Penfold's results this view cannot be held. The alcohol obtained by such saponification must be carefully

examined before deciding on its nature. The investigation into the ester and its derived alcohol was unfortunately interrupted by the destruction of the principal grove of trees by fire, and the material collected just before the fire had been seriously affected by a drought, so that the ester content was low.

The (presumably) new alcohol is a colorless, somewhat viscid liquid of a pleasant odor suggesting the geranium. It combines very slowly and with difficulty with phthalic anhydride, and not at all with anhydrous calcium chloride under conditions in which geranol would produce combinations. Its constants are:

Specific gravity at 15°/15° C.	0.9559
Boiling point	108-111° C.
Optical rotation	+38.6°
Refractive index 20° C.	1.4918

H. L.

SOLID EXTRACTS

All farmers and gardeners, professional or amateur, know that there are such things as weeds, but most people would have some difficulty in defining one. The same plant may be a valued flower in one location and a despised weed in another, as are the poppies in the wheat in "Flanders Fields." But scientists like to put names and tags on things, even weeds, and so an attempt has been made to give a strictly scientific definition of weeds by a writer in a recent scientific journal. Here it is: "A weed is an independent plant whose species is persistently obnoxious on cultivation areas." Weeds, as everybody knows, are obnoxious; hence, of course, if a plant is obnoxious it is a weed.

Sir Almroth Wright, eminent British surgeon, has attacked the long-established theory the white corpuscles of the blood devour disease germs.

While he finds corpuscles repel the germs, he says there is no contact between them, and that the defense of the corpuscles consists in their emitting a secretion which either kills the invaders or prevents their massing in colonies.

Lobelin, an alkaloid isolated from lobelia leaves in German gardens, has proved valuable in stimulating lung action in case of asphyxiation by carbon monoxide, according to the announcement of a Hamburg chemical firm. The preparation proved valuable in rescuing miners overcome by carbon monoxide during a recent mine explosion in Upper Silesia, it is stated.

Carbon monoxide is an intensely poisonous but quite odorless gas given off by automobile engines, and

many cases of poisoning have occurred in closed garages, tunnels, and taxi stations.

The addition of small quantities of potassium iodide to fertilizers has been found by French scientists to increase materially the yield of sugar beets. Larger amounts decrease the yield of sugar in the beets. It is thought that the iodine has an important effect upon he power of the plants to utilize the energy of the sunlight for the transformation of plant food into plant substance.

A recent German bacteriological study of the relative cleanliness of paper and metallic money has shown the coins to be much the more sanitary. On the banknotes which had been some time in circulation and subjected to frequent handling, as many as 143,000 bacteria were found. The *Lancet*, an English medical journal, says: "Infectious diseases may be spread by paper money more frequently than by any other article in use among the people. The dirtiest piece of copper is, from the standpoint of the bacteriologist, better than newly issued paper money." The coined money is harmless because its smooth surface does not accumulate bacteria and because of the specific germicidal action of the metal itself.

It is stated that a substance possessing in a certain degree the qualities of insulin, as prepared from animal pancreas, is present in the pancreas of certain fishes. It has also been discovered in yeast and certain green vegetables, such as grass and beans. Whereas, however, insulin obtained from animal pancreas acts within a few hours, that from these other substances has no effect for at least twenty-four hours. Experiments are now being carried on at the London Hospital on the extraction of insulin from grass and beans. The process is still in an experimental stage, and the only sources of insulin at the present time are the expensive ox, calf, and sheep pancreas.

Pollen, the fertilizing or male element in plant reproduction, has been the object of studies by S. Nohara, reported in the Japanese *Journal of Botany*. Mr. Nohara used pollen from several species of willow, subjecting it to various conditions, and determined how long it could be kept and still have power to germinate. Kept in a dry, cool, dark place, pollen was still alive after seventy days. Temperatures as low as 4 degrees below zero Fahrenheit had no effect on it in eight hours, but at 98 degrees above zero it died. Chloroform vapor terminated the germinating power of pollen in four or five hours, and ether vapor in twenty hours. It was found possible to induce the pollen to germinate by placing it in sugar solutions, of a strength from two to five per cent.

Daffodil bulbs, which superficially resemble onions, have sometimes been eaten for them by mistake and have caused serious poisoning. A case was reported not long ago in Edinburgh where a cook took a daffodil bulb for an onion and used it to flavor a stew subsequently eaten by five persons. All were made acutely sick before the end of the meal, with

symptoms of violent gastro-intestinal disturbance. All recovered in a few hours and apparently suffered no after effects of the dose. The poisoning is supposed to be due to a principle known as "narcissine," found in the bulbs of daffodils and jonquils. Persons keeping daffodil bulbs in the house should take care that they are not confused with onions.

The culture of eucalyptus trees may be largely extended in this country if experiments now being conducted by the U. S. Forest Service prove successful. A Forest Service scout recently found a species of the eucalyptus known as the "Snow Gum," growing in Australia under conditions that are fatal to the usual varieties of the tree. The "Snow Gum" is said to be able to withstand temperatures as low as 16 degrees below zero. The tree is now being raised at the Forest Service station at Asheville, N. C., and if it survives the winter, other trees of the same species will be used to plant arid slopes in the southwest where native trees have difficulty in becoming established.

Termites or "white ants" are blamed for the backwardness of the Tropics. Because of these insects' insatiable appetite for wood, houses, furniture, stores and fences fall to dust when a few days before they appeared perfectly sound on the surface. Railroads through tropical forests cannot use wooden ties, but must import at great cost iron or steel ties which will not tempt the termites. Nor can the insects be fooled by making the wood into paper and the paper into books. They can go through a twelve volume set of Shakespeare quicker than an experienced scholar of Elizabethan drama. Their wood-eating proclivities have held back higher learning as well as material progress.

A French chemist named Wildier in 1900 found that yeast contained a substance which in extremely small quantity would greatly increase the growth of the yeast plant. He named it "Bios" but was not able to isolate it. Since then many chemists have been on its track but none could get it out in a pure state till now, when Professor Eddy has obtained it in clean crystalline form. It is sufficiently pure to have a definite melting point, 223 degrees centigrade, and can be analyzed. It is found to contain five atoms of carbon, eleven atoms of hydrogen, one atom of nitrogen, and three atoms of oxygen in the molecule. Professor Eddy, when questioned as to its chemical structure declined to commit himself positively at present but said that it might be regarded as "a reduced pyridine ring."

The same product can be extracted from alfalfa. Bios has remarkable potency as a stimulant to growth. An amount no more than three hundredths of a milligram, which is about as much of the powder as could be caught on the point of a pin, given every day to a young rat stunted by living on a deficient diet will cause it to grow again at a normal rate.

That sea-water contains what the chemist calls "an appreciable amount" of gold is a fact not commonly known. The following is an extract from page 6 of the annual bullion

letter, 1923, published by Samuel Montagu & Co., London, Eng.

"We have referred in a previous annual letter to the presence of gold in sea water. It is reported that the quantity has been recently reduced from one grain to under one-thousandth part of a grain per ton of sea water. We have been informed that experts in England, and in America, have shown that one metal can be changed into another at certain periods by radio-activity, such as when there are sun spots. At such a time there is immense radio action upon the earth, and this is said to be the only possible explanation of the disappearance of so large a proportion of the gold in sea water. Hence, though gold has been actually recovered from sea water at a considerable cost, its extraction is now still less a paying commercial proposition."

Fresh eggs are extolled as probably second only to cod-liver oil as a source of one of the indispensable vitamins by Dr. D. Breese Jones, chemist in charge of the protein investigation laboratory of the U. S. Department of Agriculture. They are rich in vitamin A, which promotes growth and prevents a serious affection of the eyes.

It was found that a luckless sore-eyed stunted rat, afflicted because of the lack of vitamin A in his diet, could be completely cured in a short time by the administration of from half to three-quarters of a gram of whole fresh egg daily. An average sized egg weighs about fifty grams. Dr. Jones emphasizes the fact that the eggs used were strictly fresh and were laid in summer when the hens had access to fresh, green feed, itself rich in vitamins.

Many specimens of the Chinese wood-oil or tung-oil tree, which was introduced into Florida some years ago by the U. S. Department of Agriculture, are now coming into bearing. The oil is expressed from the nuts, and is considered one of the most valuable in the paint and varnish industry. It is one of the best "drying oils" known and is particularly desired in the manufacture of waterproof varnish. The tree does best in a warm climate and does not bear when frequently subjected to temperatures lower than 20 degrees. It has handsome dark green foliage which it sheds during the winter. It is estimated that there are now more than 39,000 of these trees in Florida, 3300 of which are in bearing.

The jumping bean, a curiosity which is on sale in London and the provinces, has recently been the subject of an inquiry in the *Glasgow Herald*, in reply to which a correspondent gives the explanation, which may be familiar to some of our readers, but new to others. This "bean" exhibits the peculiar property of occasional sudden jerky and apparently spontaneous movement. Botanically it is a segment of the triply divided fruit of a large Mexican sponge, *Sebastiani Palmeri*, and, as Sir Ray Lankester tells us in one of his interesting popular science papers, the "jumps" of the "bean" are caused by a yellowish-white grub, a caterpillar having eight pairs of legs. This creature ensconces itself in the cavity of the capsule

to which, even if forcibly removed, it returns. It has been watched through a glass inset in the capsule, and its movements examined. The caterpillar rears itself from the lower surface of the capsule, and, with its hard brown plated head, gives a series of sharp blows to the roof, projecting its body with each blow, and this overbalances the capsule. It is said that gentle heating of the capsule stimulates the insect to a more vigorous gymnastic display, and consequent increased amplitude and frequency of the "jumps" of the "bean."

NEWS ITEMS AND PERSONAL NOTES

REPORT OF THE 1924 MEETING OF THE PENNSYLVANIA PHARMACEUTICAL ASSOCIATION.—The meeting was held at Hotel Bethlehem, Bethlehem, Pa., June 17, 18, 19, 1924.

The sessions were presided over by P. Henry Utech, of Meadville.

The first session was devoted almost entirely to the reception of delegates from other bodies and the reports of the Executive Committee, secretary and treasurer.

At the second session committee reports were presented as follows: Committee on Botany, W. J. Stoneback.

Committee on Drug Market, John G. Roberts.

Committee on Legislation, W. L. Cliffe.

The report of the Committee on Trade Interests was prepared and presented by Charles T. Pickett, owing to the illness of B. E. Pritchard, the chairman of that committee.

The third or formal session was opened with prayer by the Rev. C. D. Huber, of Bethlehem, and was addressed by the Hon. James M. Yeakle, mayor of the city of Bethlehem, who welcomed the association to the city. This was responded to by Charles H. LaWall.

An address on behalf of the Medical Association of Bethlehem by Dr. W. L. Estes was responded to by Ambrose Hunsberger.

Another address on behalf of the Business Men's Association of Bethlehem, by A. H. Buck, was responded to by J. C. Peacock.

The president's address was also read at this session.

The fourth session was addressed at some length by Dr. W. G. Turnbull, of the Pennsylvania Department of Public Health. Dr. Turnbull emphasized particularly the work which has been done by

the State in the conservation of health and touched also on the possible co-operation of pharmacists in this worth-while endeavor. (This address will appear in its entirety in the proceedings and is well worth the time it will take to read it.)

At this session the association was also addressed in the interest of the A. Ph. A. Pharmacy Headquarters Building by President H. V. Arny and ex-Presidents Samuel L. Hilton, J. A. Koch and Charles H. LaWall.

The matter of a contribution to this fund was later referred to the Executive Committee for action.

The report of the Committee on Time and Place of next annual meeting showed that considerable rivalry existed among the various communities desiring to entertain the association next year. Each of the following extended invitations: Buena Vista Springs, Altoona, Johnstown, Williamsport and Washington.

After considerable discussion the association voted to meet in Washington, Pa., next year.

During the fifth session Paul S. Pittenger gave an illustrated lecture on "Biological Testing."

The balance of the session was devoted to the reading of papers under the auspices of Mrs. Charles H. LaWall, chairman of the Committee on Papers and Queries.

During the course of this session E. Fullerton Cook, chairman of the U. S. P. Revision Committee, spoke on the coming U. S. P. X. The speaker also exhibited a copy of a Chinese translation of the U. S. P. IX.

During the sixth session a paper criticizing the operation of the Pennsylvania Pharmacy Law as it relates to the acquisition of experience was read by W. Wilson McNeary.

After considerable discussion the two following motions were made, seconded and carried.

> "1. That the consideration of the question of amending the Pharmacy Law as it relates to experience obtained in Pharmacies and Hospital Dispensaries, be referred to the incoming Legislative Committee.
>
> "2. That the Pennsylvania Pharmaceutical Association in convention assembled requests that the Board of Pharmacy make a survey of Hospital Pharmacies or Dispensaries and report their findings to the Association at its next annual meeting."

At the seventh session Ivor Griffith delivered a popular lecture on "A Drop of Blood."

The report of the Pennsylvania Board of Pharmacy was also presented at this session by its secretary, L. L. Walton.

At this session Mr. Saunders Norvell, of New York, gave a talk on "Methods and Ideas in Merchandizing." This was followed by a talk on "Drug Store Problems," by C. L. Bonta.

The report of the Committee on President's address was also presented at this session. The report was adopted and the association went on record in favor of each of the following propositions, which were recommended in the address of President Utech:

1. The appointment of a committee by the incoming president for the purpose of presenting at the next annual meeting a plan of reorganization of the association which will provide for ample funds and the suitable machinery to meet the modern requirements of the association. Consideration to be given to the possibilities of linking up in a binding manner the collection of dues and the increase of membership through co-operative alliance with the various local pharmaceutical organizations throughout the State.

2. Approving the purposes and principles that are involved in the various bills that have been before Congress on price standardization and maintenance.

3. Recommended that each individual member of the association refuse positively to receive merchandise for which the shipper had received no order.

4. Opposition to over priced merchandise.

5. Recommending legislative action that will bring about suppression of the practice of operating stores under fictitious titles.

6. That the widest possible publicity be given all true facts relating to the illegitimate sale of narcotics and alcohol, and recommends the expulsion from membership of any member convicted of such practices.

7. Continued affiliation with the N. A. R. D. and the American Fair Trade League.

8. The adoption of the code of ethics of the American Pharmaceutical Association.

At the eighth session the newly-elected officers were installed and the balance of the evening devoted to entertainment features.

Mr. H. A. B. Dunning, of Baltimore, was elected to honorary membership in the association.

The following officers were elected to serve the association for the ensuing year:

President, Ambrose Hunsbegrer, Philadelphia.
First Vice-President, Peter G. Walter, Pittsburgh.
Second Vice-President, Cecil R. Bloom, Clearfield.
Treasurer, F. H. E. Gleim, Lebanon.
Secretary, Louis Saalbach, Pittsburgh.
Local Secretary, F. C. Lewis, Washington.

BOOK REVIEWS

QUALITATIVE CHEMICAL ANALYSIS, A Systematic Course of, by Henry W. Schimpf, Ph. G., M. D., Professor of Analytical Chemistry in the Brooklyn College of Pharmacy. Fourth edition. Revised by Alfred I. Cone, Phar. D., Ph. G. 194 pages 6 x 9. Cloth, $1.75, net. John Wiley and Sons, Inc., New York, 1924.

In comparing this edition with the preceding edition we find but few changes. The short-cut processes have been omitted, as has been some of the matter on chemical theory, the reviser feeling that there was danger of the student depending too much on the short-cut processes, and that he should have received his instruction on chemical theory from other sources. The present volume very properly contains new matter on the subjects, ionization, mass action, and analysis by use of the Bunsen flame.

The tests given for the detection and identification of the so-called "Bases" and "Acids" are essentially those found in any good manual on qualitative analysis, as are those given for qualitative urinalysis. Perhaps the outstandingly valuable feature of the book, to anyone not taking a college laboratory course, is the thirty-five page series of tests for the identification of many important organic chemicals which the pharmacist meets in his daily practice, and this feature warrants for it a place on the laboratory book table.

In a review of the third edition (A. J. P., Vol. 90, p. 59), attention was called to a number of errors, and at the same time the author was furnished in a private communication with a long

list of others that appeared in the book. A comparison of the two texts indicates that the subject matter was largely, if not entirely, reset for the fourth edition. Why, then, should so many of the errors (nearly all, be it said), of the former book be perpetuated in the latter? They cannot be blamed on the compositor. Authors and revisers owe it to prospective users of their books (particularly learners, who cannot be expected to detect even minor errors), to exercise every possible degree of care in the submission of "copy" and the reading of "proof," so that the finished product shall be as nearly correct in its statements as it is humanly possible to make it.

F. P. Stroup.

Allen's Commercial Organic Analysis, Volume I, Fifth Edition. Revised and in large part rewritten. 796 pages. Cloth, $7.00. P. Blakiston's Son and Company, Philadelphia, 1923.

The contents of the volume are: Introduction, by William A. Davis, B. Sc., A. C. G. I.; Alcohols, by L. M. Burghart, B. A., M. A.; Malt and Malt Liquors, by Julian L. Baker, F. I. C.; Wines and Potable Spirits, by Lewis Eynon, B. Sc., F. I. C.; Yeast, by Emil Schlichting, Ph. D.; Neutral Alcohol Derivatives, by Henry Leffmann, M. A., M. D., Ph. D., D. D. S.; Sugars, by Lewis Eynon, B. Sc., F. I. C.; Starch and Its Isomerides, by T. H. Pope, B. Sc., F. I. C.; Paper and Pulp Testing, by E. Sutermeister, S. B.; Aliphatic Acids, by Hugo Schlatter, B. S., M. S.

Each of the men named is an authority on his subject and this is reflected in each case by his work as it appears in this book. Most of the articles have been very largely rewritten and amplified by the addition of new matter. Particularly is this true of the articles on Alcohols, Sugars, Paper and Aliphatic Acids, the expansion in these cases being 25 to 40 per cent.

"Allen's" always has stood high in the favor of chemists, especially those whose work calls for the use of the latest and best obtainable information on chemical analysis, and this volume, the first one to appear of a revision of the entire work, offers no reason for a recession in favor. It is hard to see how an organic analyst can very well get along without it.

F. P. Stroup.

DIE NATUERLICHEN PFLANZENFAMILIEN (Engler and Prantl). Second enlarged edition, A. Engler. Vol. 10. 478 pages. 420 illustrations. 36 goldmarks ($6.60). Wilhelm Engelman, Leipzig, Germany.

Volume 10, just published, deals with mosses (musci) comprising mainly the common mosses and the peatmosses. The book was prepared by W. Ruhland, H. Paul and V. F. Brotherus. Although much new information is added, the general character of this taxonomic standard work has been retained.

In the general part are enumerated a comprehensive general bibliography, which covers publications, published by workers all over the world. A general description follows of the vegetative and generative reproduction processes observed in this class of organisms and of the morphological and microscopic characteristics of the plants or plantparts. Constant reference is made to important taxonomic characteristics, based on morphological or anatomical modifications.

Of special interest to the pharmacist is the subject of peatmosses. Well over 200 special publications are listed, many published during and after the Great War and as recent as 1922, dealing with the utilization of certain peatmosses for surgical bandages, etc. In this country especially Nichols and Hotson have materially assisted in making domestic supplies, found near Seattle for instance, available as a substitute for cotton, which it greatly excels in water absorbing power. The detailed botanical descriptions together with abundant illustrations should prove very helpful in identifying mosses collected. Interesting physiological data are added as to soil conditions favorable or unfavorable to growth, such as that the spores of peatmosses will only grow on acid substratas, and that contrary to common belief, it is not so much lime, which is harmful to growth, but the hydroxylions, causing the alkaline reactions of alkalies. It is also pointed out that many forms can thrive with very small amounts of mineral salts on account of the acid character of the cell membranes, readily absorbing traces of mineral substances from water. Statements on fossil species, and the utilization of peatmosses or peat in medicine, as fuel, bedding, insulating material, etc., conclude the interesting discussion.

The information, evidently is up to date, the print and illustrations are clear, the paper is good, altogether the book is a worthy

addition to the previous issues and a real credit to the authors, editor and publisher.

ARNO VIEHOEVER.

The Verein Wissenschaftlicher Verleger, Berlin, a consolidation of a number of publishers, submit the following two numbers of "Sammlung Goeschen," popular treatises in natural science:

HEIL—GENUSS—GEWUERZ—UND FARBSTOFFE AUS DEN TROPEN UND IHRE VEREDLUNG. Von Dr. phil., Dr. rez. pol. Th. Sabalitschka, Privatdozent an der Universität Berlin. 133 pp.

This is the latest addition to the "Sammlung" which now number 874. The author, a well known assistant in the Pharmaceutical Institute in Berlin, very cleverly divided the tropic plants into three classes: Medicinal Plants, Spices and Coloring Agents. How thorough the different monographs are prepared can be seen from the one on Opium which occupies four pages and contains: Origin, Habitat, Description of the Plant; Formation, Collection and Description of Opium, Constituents, Manufacture and Separation of Alkaloids, Action and Uses.

The little book fills a want. It is admirably suited to put in your pocket and use as reference.

EUROPÆISCHE NUTZPFLANZEN. Von Dr. W. Waechter in München. Mit 16 Abbildungen. 133 pp.

The little volume is divided into 1, Plants as Food (containing starch or sugar, berries, etc.); 2, Economic Plants (containing oil, tannin, colors, etc.); 3, Medicinal Plants; 4, Plants for Animal Food, and 5, Fungi and Bacterias. The index of 10 pages of three columns each is an excellent testimonial of the value of this little book on the Economic Plants of Europe.

OTTO RAUBENHEIMER, Ph. M.

THE SCIENTISTS' REFERENCE BOOK AND DIARY 1924. Leather 186 pp. 3s. 6d. Jas. Woolley Sons & Co., Ltd., Manchester.

This Reference Book and Diary is now in its twenty-sixth year and has established a name for itself. It is a miniature li-

brary of chemical and scientific information as can be realized from the following few abstracts from the table of contents: Physics of the Earth, Astronomy, Barometry, Thermometry, Hydrometry, Physical and Chemical Laws, Dynamics, Light, Heat, Dangerous and Inflammable Substances, Logarithms, Test and Volumetric Solutions, Indicators, Chemical Composition of Foods, First Aid, Universities of Great Britain and Ireland, Societies, etc.

It is indeed remarkable how such a wealth of information can be condensed in such a small volume. It is a "multum in parvo."

OTTO RAUBENHEIMER, Ph. M.

THE STUDENTS' POCKET PRESCRIBER AND GUIDE TO PRESCRIPTION WRITING. By David Mitchell Macdonald, M. D., F. R. C. P. E. 207 pp. 3s. E. and S. Livingstone, Edinburgh, 1924. Matthews & Co., St. Louis, Mo.

This excellent little book is now in its eighth edition. We want to call special attention to the chapters on Incompatibilities, Numerals commonly used in Prescriptions, Vocabulary of Latin Words and Phrases, Prescription Abbreviations and The Abstract of the Dangerous Drugs Act, similar to our Federal Narcotic Law. Not only pharmaceutical and medical students but pharmacists and physicians can profit by this handy little book.

OTTO RAUBENHEIMER, Ph. M.